TREATMENT DEMONSTRATION PLAN FOR THE HOVIC RCRA LANDFARMS

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ST. CROIX, VIRGIN ISLANDS

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TH/85/268
13 September 1985

Ms. Kathy Tobin
Environmental Engineer
Region II, U.S. ENVIRONMENTAL PROTECTION AGENCY
Room 905, 26 Federal Plaza
New York, New York 10278

SUBJECT: TREATMENT DEMONSTRATION PLAN for the HOVIC RCRA LANDFARMS

Dear Kathy:

In order to assist you in preparing for your site visit to St. Croix on 19 and 20 September 1985 to see the HOVIC landfarms, I am bringing to you today a copy of the HOVIC Treatment Demonstration Plan. Please note Page ii which is the Executive Summary to the document. The new statistical approach is not yet incorporated in this package but will be sent to you shortly as an addendum to this material.

We are giving you the Treatment Demonstration now rather than ten days after the Consent Agreement and Consent Order becomes effective; the document satisfies paragraph 4 of the Consent Agreement and Consent Order which I understand is in the process of being fully executed and entered by your agency.

I am looking forward to being with you to see the landfarms and look over the Hazardous Waste Management Records at St. Croix next week. As you requested, Barry Sams and John Floyd will be available to conduct a tour of the facility and landfarms on 19 September 1985 and Mike Corn is arranging his schedule to be with us in St. Croix on 20 September 1985 to go over the RCRA file with us. I understand that Judy Meritz is forwarding to us a Confidentiality Agreement that Region II has used previously for site visits by contractors. We have not yet received that text, but would expect the Agency's contractors to execute a suitable Confidentiality Agreement prior to examining the facility or any confidential HOVIC records.

Yours truly,

T. Helfgott, Ph.D., P.E.
Environmental Affairs Manager

TH:em
Copies to: R. F. Wright
R. L. Sagebien
F. L. Pearlmutter

TREATMENT DEMONSTRATION PLAN FOR THE HOVIC RCRA LANDFARMS

Prepared for:

HESS OIL VIRGIN ISLANDS CORP.
St. Croix, Virgin Islands

Prepared by:

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P. O. Box 1147
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September 1985

September 12, 1985 2005.12

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Environmental Affairs Manager
Amerada Hess Corporation
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Mr. Barry Sams
Environmental Manager
Hess Oil Virgin Islands Corp.
Kingshill, P. O. Box 127
St. Croix, U.S. VI 00850

Subject: Treatment Demonstration Plan for the HOVIC RCRA Landfarms

Dear Dr. Helfgott and Mr. Sams:

At your request, I have completed the Treatment Demonstration Plan for the HOVIC landfarm. I have incorporated comments received from you, EPA and several other consultants in this field. The plan submitted incorporates the existing data base of landfarm applications that HOVIC has maintained since November 1980. These data have been tabulated and a one-time intensive field data collection study is proposed from which waste degradation rates will be determined. The critical pathyway in accomplishing the objectives of the proposed field study is being able to achieve limits of detection consistent with expected constituent concentrations in the treatment zone. To this end, I believe it is prudent to meet with EPA's technical people to discuss appropriate methods prior to the initiation of this study.

The proposed plan is consistent with the recommendations given in the EPA Guidance Documents and also with the available literature on Treatment Demonstrations. If you should have any questions or comments concerning this Study Plan, please call me at (615) 377-4775.

Sincerely,

Michael R. Corn

Michael R. Corn, P.E.
Consultant

P.O. Box 1147 • Brentwood, TN 37027 • (615) 377-4775 •

EXECUTIVE SUMMARY

TREATMENT DEMONSTRATION PLAN FOR THE HOVIC RCRA LANDFARMS

HOVIC operates a regulated landfarm system for the treatment of Resource Conservation and Recovery Act (RCRA) listed oily sludges produced at the St. Croix refinery during the processing of petroleum. In addition to the RCRA listed wastes, HOVIC uses the landfarms for the treatment of non-regulated waste sludges such as crude oil tank bottoms and sulfur recovery product treating solution (Beavon Froth). A separate HOVIC Waste Analysis Report has been presented to the U.S. EPA on the list of agency selected constituents known as the Skinner List. As part of the RCRA Part B Permit requirements, HOVIC has developed, with input from EPA, this Treatment Demonstration Plan for satisfying the requirements of the RCRA regulations, specifically: 40 CFR 264.272 and 270.20. The Treatment Demonstration Plan is presented in the Flow Chart which follows this Executive Summary.

HOVIC has prepared in this Treatment Demonstration Plan a study of waste sludge biodegradation, toxicity, immobilization, and transformation in the on-site landfarms. The major aspects of this study include:

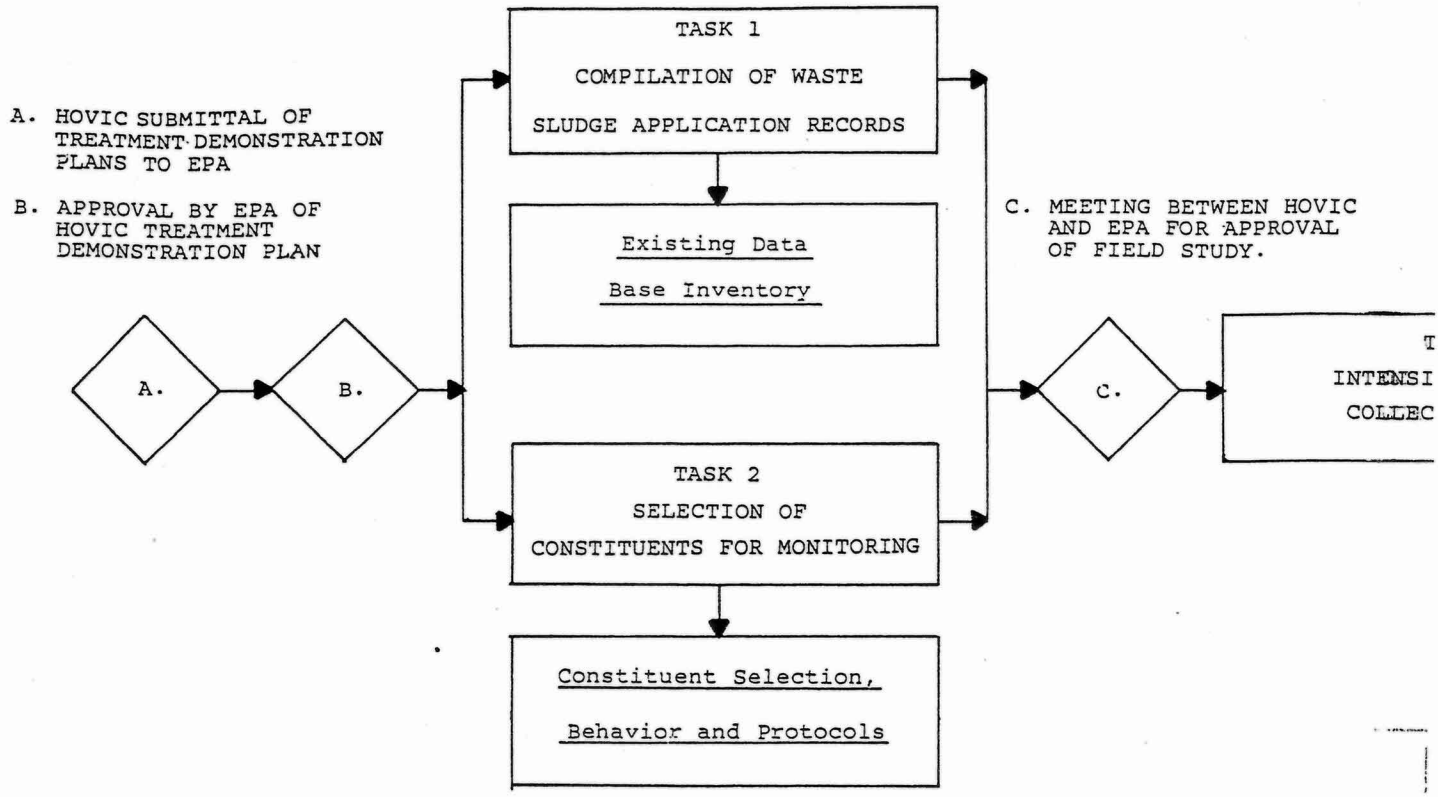
* Development of sludge application rates -- HOVIC will base this on the waste application records and treatment zone monitoring of constituent inventory;

* Determination of Rate Limiting Constituents based on the historical inventory of applied materials in selected landfarm bays;

* Soil sampling beneath the Treatment Zone of Landfarm II to determine if migration has occurred from this older landfarm unit -- composite sampling of several soil samples will be done; and

* Toxicity testing to determine if there are limiting concentrations at which waste constituents are inhibitory to micro-organisms; toxicity tests conducted using laboratory respirometer tests.

HOVIC has a unique opportunity at the St. Croix Refinery to demonstrate the effectiveness of landfarming for the treatment of degradable sludges. With less and less viable and environmentally acceptable disposal options available to refineries and other industries, landfarming at the HOVIC site is a sound, proven, economic technique which offers an optimal treatment method for the management of refinery waste sludges.


A. HOVIC SUBMITTAL OF TREATMENT DEMONSTRATION PLANS TO EPA
B. APPROVAL BY EPA OF HOVIC TREATMENT DEMONSTRATION PLAN
A.
B.
TASK 1
COMPILATION OF WASTE SLUDGE APPLICATION RECORDS
Existing Data Base Inventory
TASK 2
SELECTION OF CONSTITUENTS FOR MONITORING
Constituent Selection, Behavior and Protocols
C. MEETING BETWEEN HOVIC AND EPA FOR APPROVAL OF FIELD STUDY.
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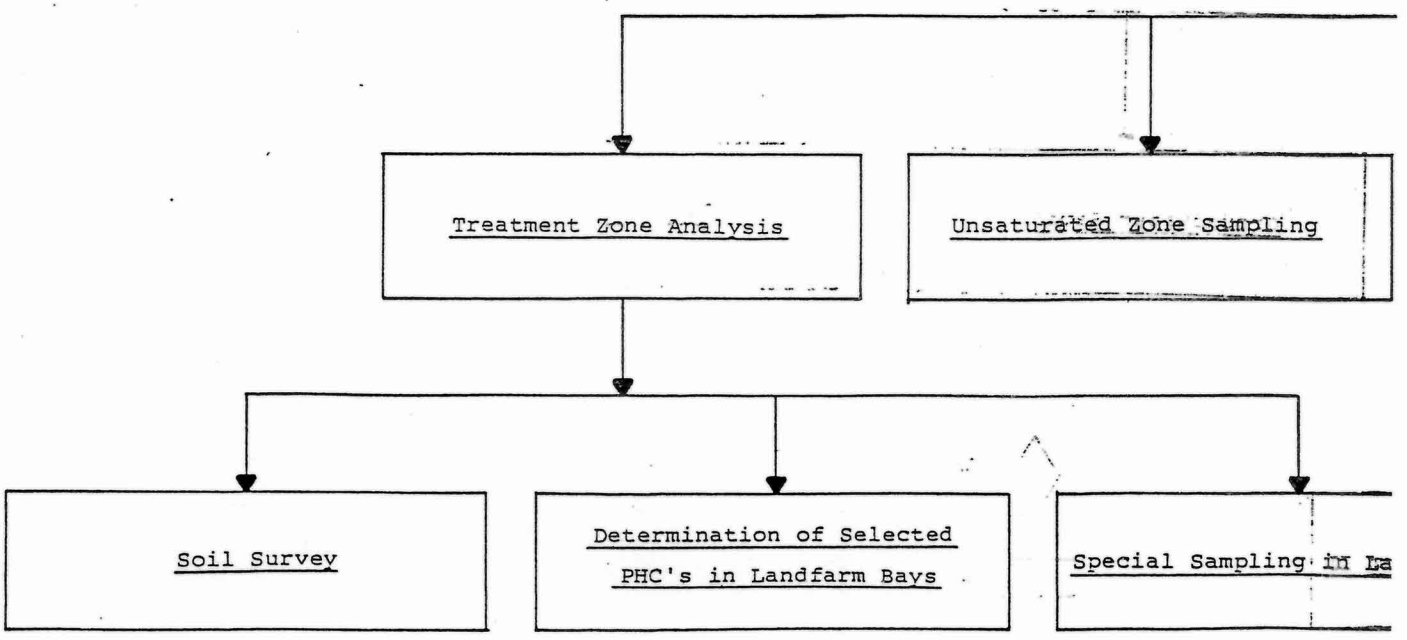

Treatment Zone Analysis
Unsaturated Zone Sampling
Soil Survey
Determination of Selected PHC's in Landfarm Bays
Special Sampling in La

HESS OIL VIRGIN ISLANDS CORP.
St. Croix, Virgin Islands

FLOW CHART
HOVIC TREATMENT DEMONSTRATION PLAN

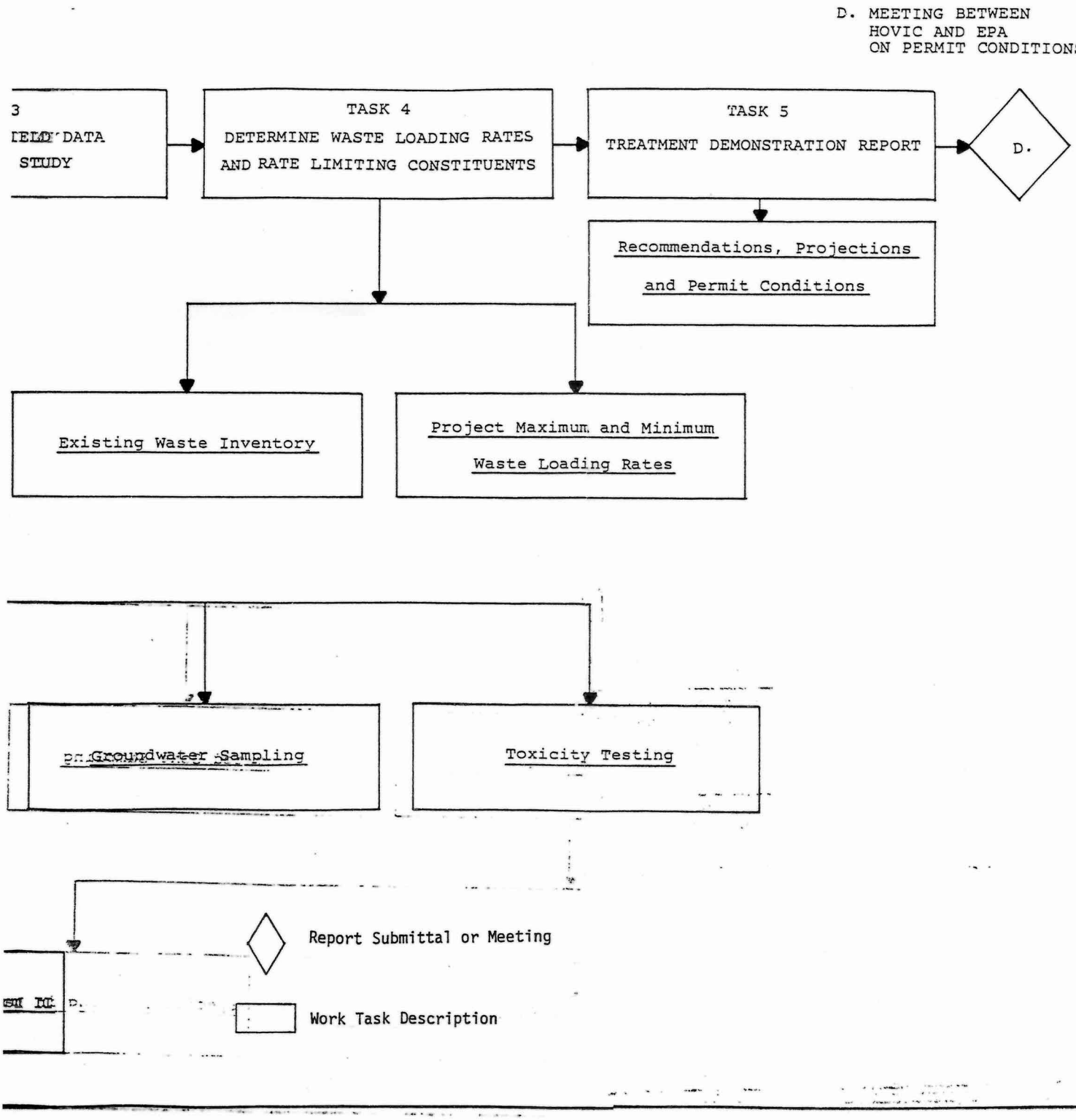


TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

SECTION 1

INTRODUCTION

SECTION 1
INTRODUCTION

HOVIC is requesting a RCRA Part B Permit for operating two landfarms as depicted in Figures 1-1 to 1-3. As part of the RCRA Permitting process, HOVIC has developed this Treatment Demonstration Plan. The intent of this Treatment Demonstration Plan is to satisfy the interpreted regulatory requirements for demonstrating effective and contained treatment of petroleum waste sludges.

WASTE SLUDGES INCLUDED IN THE DEMONSTRATION

Several waste sludges produced at petroleum refineries are included as listed RCRA wastes in the Federal Regulations 40 CFR 261. As such, these waste materials must be managed in accordance with 40 CFR 264 specifications under the RCRA Part B Permitting requirements. At HOVIC, the RCRA waste sludges which are applied to the landfarms include:

1. API Separator sludges (total about 95 percent of the wastes applied to the landfarms) -- EPA I.D.No. K051;
2. Heat Exchanger Bundle Cleaning sludges -- EPA I.D.P No.P K050;
3. Slop (Recoverable) Oil Emulsion solids -- EPA I.D. No. K049;
4. Tank Bottoms (leaded) -- EPA I.D. No. K052;

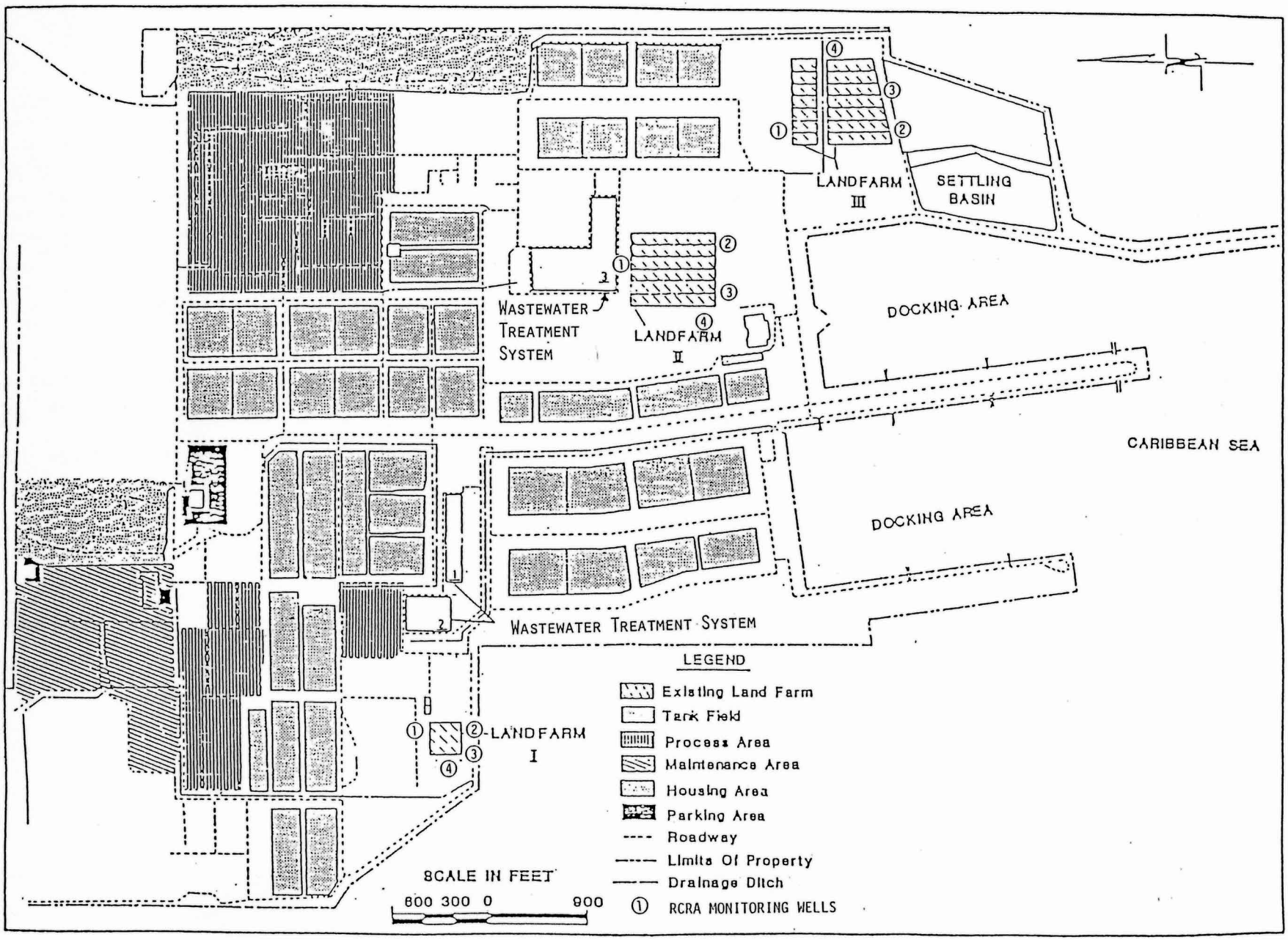
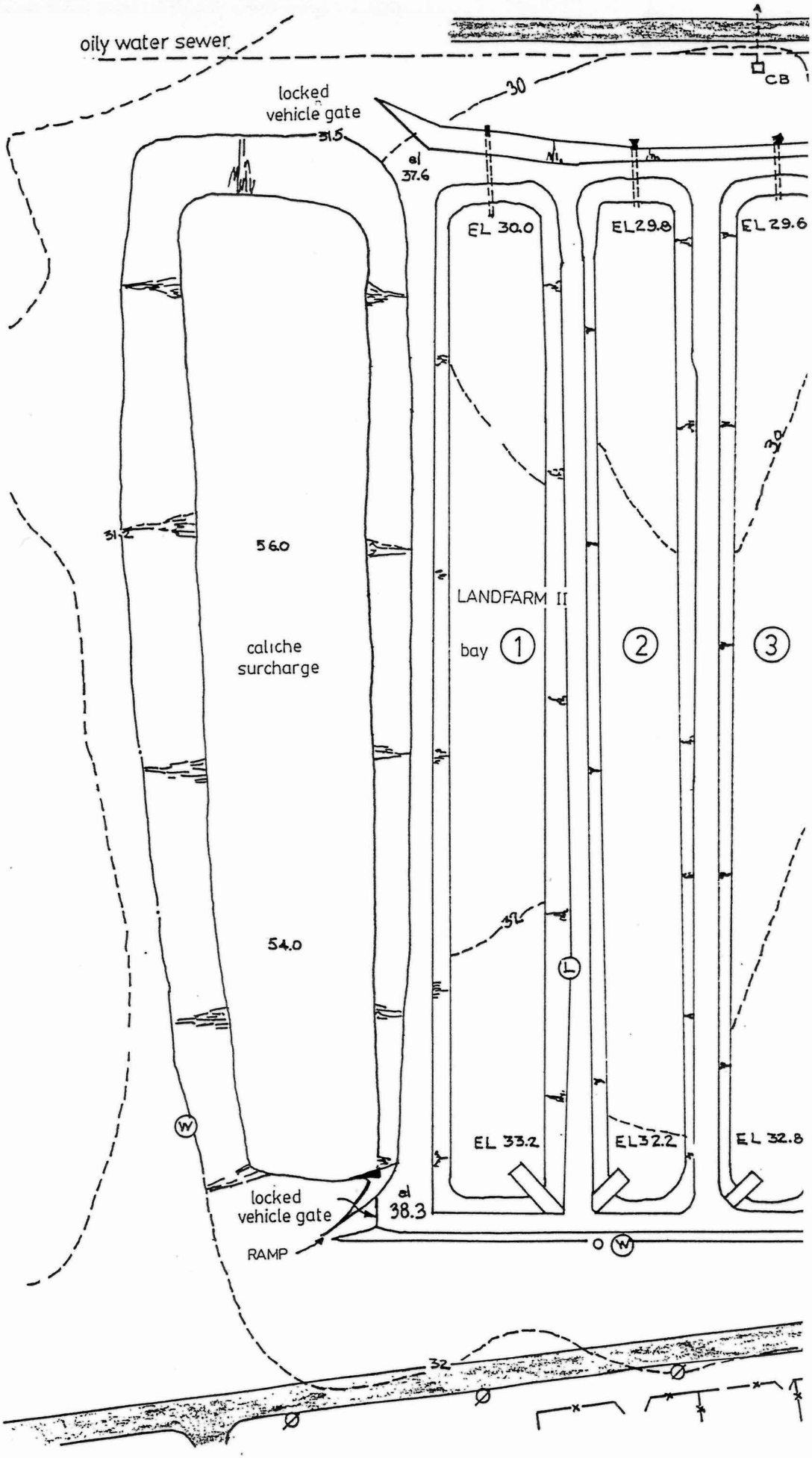


FIGURE 1-1 HOVIC SITE MAP


oily water sewer
CB
30
locked
vehicle gate
31.5
el
37.6
EL 30.0
EL29.8
EL29.6
31.2
56.0
LANDFARM II
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EL32.2
EL 32.8
locked
vehicle gate
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38.3
RAMP
W
32

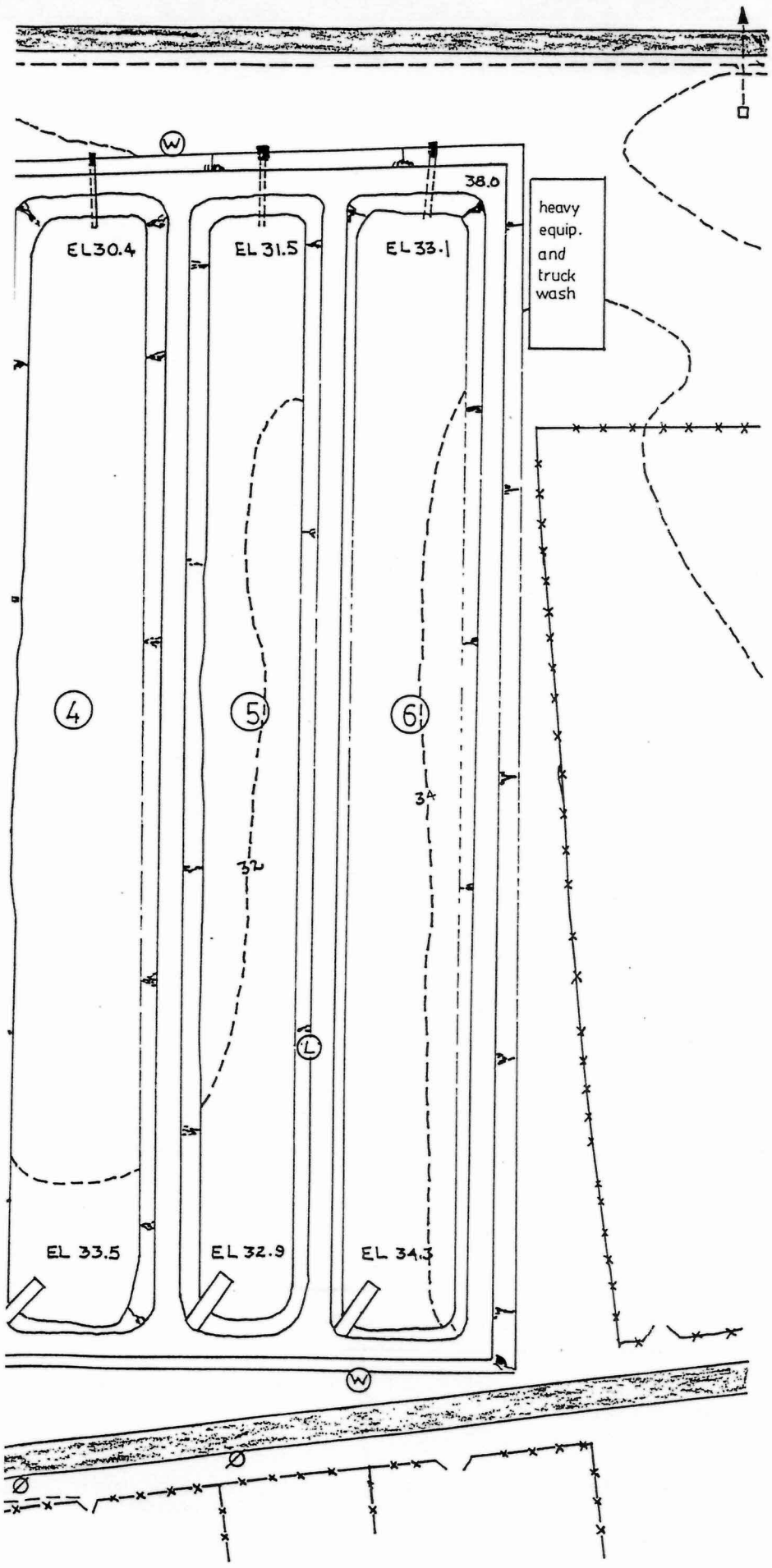
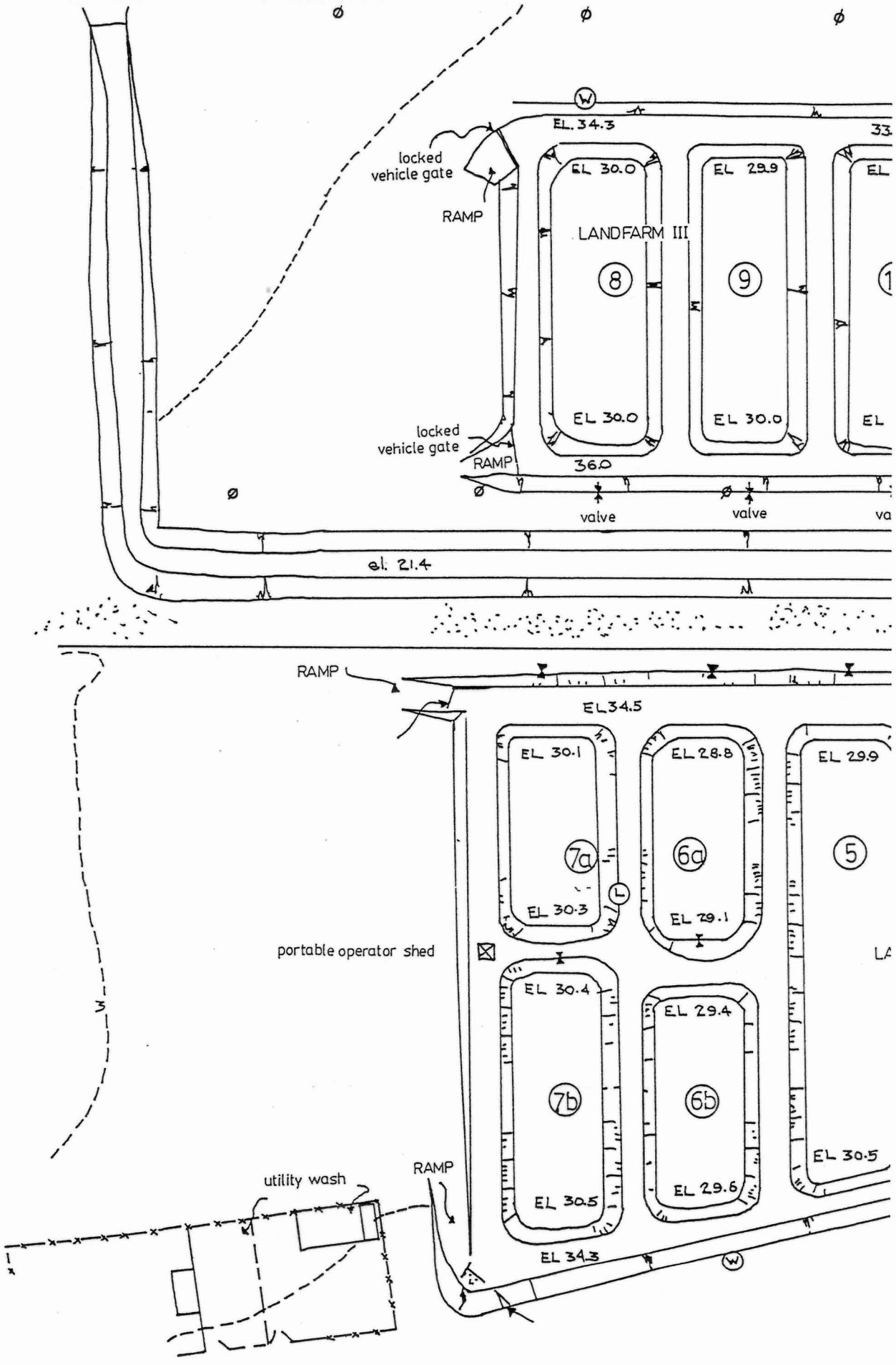


FIGURE 1-2

HOVIC LANDFARM II


EL. 34.3
locked vehicle gate
RAMP
LANDFARM III
EL 30.0
EL 29.9
8
9
EL 30.0
EL 30.0
locked vehicle gate
RAMP
36.0
valve
valve
el. 21.4
RAMP
EL34.5
EL 30.1
EL 28.8
EL 29.9
7a
6a
5
EL 30.3
EL 29.1
portable operator shed
EL 30.4
EL 29.4
7b
6b
EL 30.5
EL 29.6
EL 30.5
EL 34.3
utility wash
RAMP

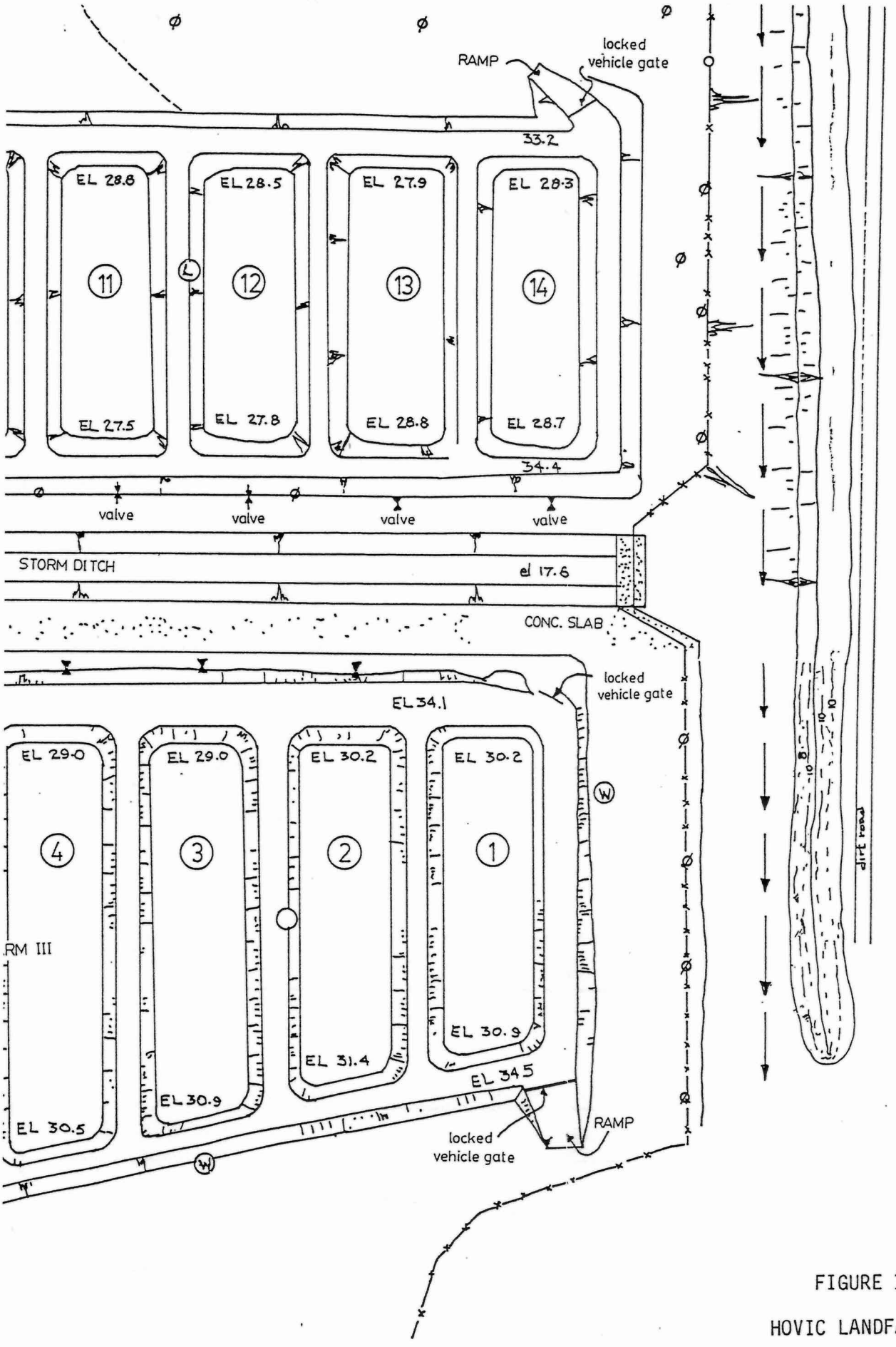


FIGURE 1-3

HOVIC LANDFARM III

- Hess must load Beavon Froth at a similar rate during demo as they anticipate in full scale operation - what about PHC waste?

Other waste sludges which are applied to the landfarms include:

5. Beavon Froth/Sulfur wastes (contains 80 percent Stretford Solution) -- not a RCRA waste; and
6. Crude Oil Tank bottoms -- not a RCRA waste.

A Waste Analysis Report presenting the analytical results for these six waste sludges for the Skinner list of constituents was submitted to the EPA on 9 April 1985 and a summary of the waste analysis results is given in Table 1-1. Along with this report, an analysis of the behavior of those constituents in the environment was also presented. Based on these results and the analysis of the behavior of the constituents, the Principal Hazardous Constituents (PHC's) selected for the Treatment Demonstration study are:

* barium
* chromium
* lead
* vanadium
* benzene
* toluene
* 2,4-dimethylphenol
* benzo(a)pyrene
* naphthalene

In addition to these PHC's, HOVIc also intends to include the following selected indicator parameters in the sampling and analytical program:

TABLE 1-1. SUMMARY OF HOVIC WASTE ANALYSES RESULTS

CHEMICAL CLASS (FROM THE SKINNER LIST OF PETROLEUM REFINERY WASTE CONSTITUENTS)	UNITS	1. API SEPARATORS (COMPOSITE)	2. HEAT EXCHANGER BUNDLE WASH	3. BLIND FIELD DUPLICATE (SAME AS 2.)	4. RECOVERABLE OIL TANK SLUDGES	5. LEADED GASOLINE STORAGE TANK SLUDGES	6. BEAVON FROTH/ SULFUR SOLIDS	7. CRUDE OIL BOTTOM SLUDGES
I. METALS								
1. Antimony	mg/l	Not Detected	2.30	1.70	Not Detected	Not Detected	Not Detected	Not Detected
2. Arsenic	mg/l	2.90	9.40	16	Not Detected	1.90	9.40	2.50
3. Barium	mg/l	1,370	100	100	522	342	98	100
4. Beryllium	mg/l	65	4.50	4.50	Not Detected	1.70	6.70	4.50
5. Cadmium	mg/l	2.90	4.70	4.70	Not Detected	2.40	4.10	4.10
6. Chromium	mg/l	20	24	24	27	34.80	20	24
7. Lead	mg/l	5.80	39	39	Not Detected	39	33	41
8. Mercury	mg/l	Not Detected	0.30	0.20	Not Detected	Not Detected	Not Detected	Not Detected
9. Nickel	mg/l	3.60	38	89	Not Detected	30	74	70
10. Selenium	mg/l	28	26	26	15	52	35	33
11. Vanadium	mg/l	77	191	140	Not Detected	19	5,900	26
II. VOLATILE COMPOUNDS								
15. Benzene	mg/kg	234.000	Not Detected	Not Detected	102.000	500.000	Not Detected	19.800
17. Carbon disulfide	mg/kg	0.150	0.230	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
26. Dichloromethane	mg/kg	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	13.200	Not Detected
34. Methanethiol	mg/kg	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
16. Methyl ethyl Ketone (MEK)	mg/kg	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
39. Toluene	mg/kg	595.000	Not Detected	Not Detected	10300.000	1130.000	6.700	48.900
41. Trichloroethene	mg/kg	Not Detected	Not Detected	202.000	Not Detected	Not Detected	Not Detected	Not Detected
III. ACID COMPOUNDS								
44. Cresol (Phenol, o-chloro-)	mg/kg	Not Detected	Not Detected	Not Detected	6.820	Not Detected	Not Detected	Not Detected
(Phenol, m+p-chloro-)	mg/kg	Not Detected	Not Detected	Not Detected	3.950	Not Detected	Not Detected	Not Detected
45. 2,4-Dimethylphenol	mg/kg	Not Detected	16.900	Not Detected	56.600	Not Detected	Not Detected	Not Detected
IV. BASE/NEUTRAL COMPOUNDS								
53. Benzo (a) anthracene	mg/kg	<0.670	1.760	0.600	Not Detected	Not Detected	Not Detected	Not Detected
54. Benzo (b) fluoranthene	mg/kg	<0.412	4.000	2.570	Not Detected	Not Detected	Not Detected	Not Detected
55. Benzo (a) pyrene	mg/kg	0.297	5.510	3.410	Not Detected	Not Detected	Not Detected	Not Detected
57. Bis (2-chloroisopropyl) ether	mg/kg	Not Detected	Not Detected	Not Detected	2.830	Not Detected	Not Detected	Not Detected
58. Bis (2-ethylhexyl) phthalate	mg/kg	Not Detected	0.811	0.936	Not Detected	Not Detected	Not Detected	Not Detected
61. Chrysene	mg/kg	Not Detected	1.040	0.650	<1.130	Not Detected	Not Detected	Not Detected
62. Dibenzo (a,h) anthracene	mg/kg	Not Detected	1.040	0.484	Not Detected	Not Detected	Not Detected	Not Detected
66. Dimethyl phthalate	mg/kg	Not Detected	Not Detected	Not Detected	Not Detected	0.183	Not Detected	Not Detected
70. Fluoranthene	mg/kg	0.249	0.038	0.208	Not Detected	Not Detected	Not Detected	Not Detected
71. Indeno (1,2,3-cd) pyrene	mg/kg	Not Detected	3.030	1.570	Not Detected	Not Detected	Not Detected	Not Detected
72. Naphthalene	mg/kg	14.900	2.900	1.280	8.780	115.000	Not Detected	9.460
V. B/N/A COMPOUNDS								
86. 7,12-Dimethyl-benz (a) anthracene	mg/l	<0.860	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
VI. CONVENTIONAL COMPOUNDS								
89. Cyanide, Total	mg/l	<0.50	0.60	<0.50	<0.50	<0.50	<0.50	<0.50
VII. NON-SKINNER CONVENTIONAL CONSTITUENTS								
90. oil & grease	mg/kg	43,000	96,000	87,000	215,000	320	1600	300,000

* pH
* conductivity
* total
* oil and grease or petroleum hydrocarbons
* total phenols
* Total Organic Carbon (TOC) or Chemical Oxygen Demand (COD)
* Biochemical Oxygen Demand (BOD)

The constituents have been selected to provide a description of the fate of constituents in the landfarm setting:

1. Metals will provide information on the effectiveness of the treatment zone soils to immobilize adsorbable constituents;
2. Volatile compounds (benzene and toluene) will provide information on mobility and degradation of these water soluble constituents in the landfarm setting;
3. The acid extractable compound, 2,4-dimethylphenol, is soluble in water and should provide a mobile constituent for monitoring;
4. Base neutral compounds, benzo(a)pyrene and napthalene, are adsorbable onto the soils and will provide historical data on the adsorption tendency of these biodegradable constituents; and

5. Selected indicator parameters, such as oil and grease and total nitrogen, will provide the most significant data on degradation rates.

A summary of the selected constituents and their predicted fate in the environment is given in Table 1-2.

GOALS OF THE PLAN

The Treatment Demonstration Plan has been designed to make use of the existing comprehensive data base and to provide degradation data on the actual conditions and practices at the HOVIC landfarms.

The intent of this sampling program is to construct a data base by sampling selected bays that have varying historical use patterns. That is, bays will be sampled with waste applications that occurred approximately three months, six months to nine months, one year and two years ago. The constituent inventory determined will be compared with the known application rates to the individual bay sampled. This information will be analyzed to determine:

1. the average constituent concentration in the zone of incorporation of the bay;
2. present constituent inventory in the bay in pound constituent per cubic foot of zone of incorporation.
3. plots of constituent concentration versus time using all data collected;

TABLE 1-2. CONSTITUENTS TO BE MONITORED DURING THE TREATMENT DEMONSTRATION

CONSTITUENT	PREDICTED FATE
PRINCIPAL HAZARDOUS CONSTITUENTS	
METALS	
total barium	nondegradable, adsorbable to soils
total chromium	nondegradable, adsorbable to soils
total lead	nondegradable, adsorbable to soils
total vanadium	nondegradable, adsorbable to soils
VOLATILE COMPOUNDS	
benzene	volatile, soluble in water, biodegradable
toluene	volatile, soluble in water, biodegradable
ACID COMPOUNDS	
2,4-dimethylphenol	soluble in water, biodegradable
BASE/NEUTRAL COMPOUNDS	
benzo (a) pyrene	adsorbable to soils, biodegradable
naphthalene	adsorbable to soils, biodegradable
INDICATOR PARAMETERS	
soil pH	pH > 6.5 recommended
soil conductivity	indication of salt buildup in treatment zone
total nitrogen	critical nutrient for bacterial populations
oil and grease	major component of sludges, limits application rate
phenols	possible degradation product
Total Organic Carbon (TOC)	measure of biodegradable mass being applied
Biochemical Oxygen Demand (BOD)	used with TOC for toxicity testing

4. plots of PHC concentrations with depth in the treatment zone of the individual bay sampled;
5. rate determinations or constituent buildup for each of the PHC's;
6. rate limiting constituents applied to the landfarms; and
7. selection of application rates for HOVIC site specific landfarms.

CRITERIA AND GUIDANCE USED IN DEVELOPMENT OF PLAN

HOVIC and EPA have been discussing the requirements for a treatment demonstration of EPA listed refinery Resource Conservation and Recovery Act (RCRA) waste sludges applied to the HOVIC landfarms. The discussions have centered on the particular treatment demonstration required at HOVIC. In December 1984, EPA issued a "Draft Permit Guidance Manual on Hazardous Waste Land Treatment Demonstrations" which presents criteria for choosing a land treatment demonstration plan as follows:

Criterion 1 - Are major design and operation changes planned?

Criterion 2 - Is performance of the existing HWLT (Hazardous Waste Land Treatment) unit acceptable?

Criterion 3 - Are the waste management records complete?

The guidance document also states the following:

> "This manual and other EPA guidance documents do not supersede the regulations promulgated under RCRA and published in the Code of Federal Regulations. Instead, they provide guidance, interpretations, suggestions, and references to additional information. This guidance is not intended to suggest that other designs might not also satisfy the regulatory standards."

The available data base is extensive at HOVIC and this has been incorporated into the design of the Plan. The criteria listed above are addressed in this Plan as follows:

Criterion 1 - The only operational or design change that would change the present or past waste types applied to the landfarm or the landfarm management practices is the phase down rules for leaded gasoline. This will mean a smaller inventory of lead in the treatment zone in the future. This operational change will not impact the treatment demonstration type selected.

Criterion 2 - The performance of landfarms has been monitored in the past by analyzing the concentrations of lead and chromium in the following:

- waste sludges
- unsaturated zone
  * soil cores
  * soil pore liquids (lysimeters)
- groundwaters

The performance of landfarms has been found to be acceptable based on the data collected to date. Further evaluations on landfarm performance will be made from data collected during the Treatment Demonstration. As part of the suggested Treatment Demonstration Study Plan, PHC's found in the waste sludges will be analyzed from: 1) soil samples taken from the treatment zone; 2) the unsaturated zone including soil cores and lysimeter samples; and 3) groundwater samples. The suggested intensive field study program is described in Section 2 under Task 3.

Criterion 3 - HOVIC has maintained comprehensive records on wastes applied to the landfarms since November 1980. These records have been tabulated. As described in Section 2 under Task 1, these data will be used to select appropriate bays for the intensive field sampling.

Specific guidance documents and past HOVIC submittals which have also been incorporated into the Plan are:

1. EPA. December 1984. " Draft - Permit Guidance Manual on Hazardous Waste Land Treatment Demonstrations";
2. EPA. December 1984. "Draft - Permit Guidance Manual on Unsaturated Zone Monitoring for Hazardous Land Treatment Units";
3. EPA. May 1984. "Permit Applicants' Guidance Manual for Hazardous Waste Land Treatment, Storage, and Disposal Facilities - Final Draft";
4. HOVIC. October 10, 1984. "Submittal to U.S. EPA on October 10, 1984 Concerning the HOVIC RCRA Part B Permit Application - EPA I.D. No. VID 980536080;
5. Corn, M.R. February 1985. "Evaluation of Lysimeters for Unsaturated Zone Monitoring at the HOVIC Refinery"; and
6. HOVIC. 2 May 1985. "Waste Analysis Report - RCRA Part B Permit Application".

In addition to the above mentioned documents, the following meetings and telephone conversations have been held with EPA to further develop a Treatment Demonstration Plan:

1. 10 October 1984 meeting between HOVIC and EPA representatives at EPA offices in New York;
2. 16 November 1984 submittal to EPA on the HOVIC RCRA Part B Permit Application;

3. 17 December 1984 meeting between HOVIC and EPA representatives at EPA offices in Edison, New Jersey; and
4. 23 January 1985 meeting between HOVIC and EPA representatives in New York;
5. 11 March 1985 meeting between HOVIC and EPA representatives in New York;
6. 15 March 1985 meeting between HOVIC and EPA representatives in Woodbridge, New Jersey; and
7. 9 April 1985 meeting between HOVIC and EPA representatives in New York.

The Plan worked out between HOVIC and EPA will provide the following:

1. The data necessary to meet the requirements of the regulations;
2. Full advantage of the operating history and waste sludge application records available for the HOVIC facility; and
3. Accounts for the degradation rates of the waste sludges applied to the landfarm system under actual loading conditions.

It is the intent of the suggested program to provide the necessary data required for permitting the facility from the on-going landfarm activities at the refinery. Landfarming at HOVIC represents a viable environmentally sound method of treating degradable oil sludges produced at the refinery. The recommended

program herein will provide an assessment of the following:

1. Long-term constituent inventory in the treatment zone;
2. Waste constituent degradation rates for the PHC's and other indicator parameters;
3. Identification of any rate limiting constituents;
4. Identification of any migration of constituents out of the treatment zone; and
5. Appropriate permit conditions and considerations.

The suggested Treatment Demonstration Plan is outlined in Figure 1-4. The following sections provide details of each phase of the proposed HOVIC Treatment Demonstration. This program as outlined here is phased with frequent review and input required between HOVIC and EPA as the Plan is carried out. It is important in carrying out this Plan that both EPA and HOVIC have mutual interaction at selected decision points in the study (see Figure 1-4).

SECTION 2

TREATMENT DEMONSTRATION PLAN

SECTION 2

TREATMENT DEMONSTRATION PLAN

Based on the discussions, the guidance document, operational practices, accumulated experience and data base for the St. Croix landfarms, HOVIC sees a unique opportunity for a treatment study using: 1) historical application data; 2) waste characterization data; 3) meteorological records; and 4) soil profile analyses.

The HOVIC wastes have been analyzed for the Skinner List of Constituents (a modified list of chemicals from the Appendix VIII list of hazardous constituents as contained in the RCRA regulations). This list has been adopted specifically for refinery waste sludges (3 April 1984 Skinner EPA Memorandum). These chemical analyses of the sludges applied to the landfarms, largely API Separator sludges (estimated to be about 95 percent of all applied waste), have been completed by ETC Laboratories of Edison, New Jersey. Additionally, the HOVIC Environmental Laboratory has characterized the sludges for percent moisture, percent oil and grease, and percent solids. Data results from the Waste Analysis Report were presented previously from the Waste Analysis Report in Table 1-1.

HOVIC has maintained records of application rates of waste sludges on the Landfarms going back to November 1980. By taking core samples at varying depths for selected materials analyses, a demonstration of treatment and the containment of any non-

- location of bkg plot - need to show similarity

degradable constituents such as metals in the "treatment zone" can be made. A background soil plot will be selected near both Landfarms II and III to determine the naturally occurring range in the soils of the constituents found in the waste sludges (if any).

Meteorological records for rainfall are available from on-site, and pan evaporation rates are available from a nearby National Oceanic and Atmospheric Administration (NOAA) meteorological station, Upper Bethelem Experiment Station. These data will be used to determine the ongoing water balance of net water loss or gain to the landfarm bays since November 1980.

Data on Landfarm II and III will be collected to characterize both waste degradation rates and also the historical inventory of both traditional indicator and representative principal hazardous constituents. These data will provide information on the fate of waste sludges including an estimation of waste constituent degradation, immobilization and transformation over several years of land application of refinery sludges. It is noted here that the list of constituents as presented previously in Table 1-2 includes various classes of chemical constituents, such as volatile fraction organics and base/neutral compounds as well as traditional constituents such as TOC and phenols.

The sampling program recommended is also in keeping with the Guidance Manual reference Section 3.1.3, "Are the Waste Management Records Complete?" which states the following:

> "The records described in Table 3.2 include data from recent and past operations. Since wastes are continually being treated in the system, the recent years are most important to the historical construction. As one looks further into the past, each preceding year has a diminishing impact on current treatment zone characteristics. The completeness of the records can thus be judged against two frames of reference:
>
> 1. recent activities that are most influential and require relatively detailed records of waste application rates, distribution, timing, and quality;
>
> 2. older operations that are usually less influential and require only general estimates of past activities.
>
> Based on half-lives of less than one to two years for most land treatable organic constituents in soils. (Brown, et al., 1983), four years of good records should suffice for the first frame of reference. With regard to the longer time frame, only estimates of the waste application rates are needed beyond four years."

The records for the HOVIC landfarm system are sufficiently detailed enough to provide a realistic construction of waste loadings to the individual landfarm bays including constituent loading rates.

Landfarm I will be closed in accordance with discussions between HOVIC and EPA. HOVIC does not intend to perform a Treatment Demonstration on Landfarm I. The tasks described below detail the approach to be taken.

Task 1 - Review Data on HOVIC Waste Application Rates

HOVIC has maintained operating logs called Hess Environmental Control Logs on the waste applications made to the individual landfarm bays since November 1980. An example copy of these logs is shown as Table 2-1. A compilation of these logs has been completed and individual waste loadings to each bay have been tabulated as shown in Table 2-2.

Landfarm III was first put into service around November 1980 and waste sludges were first applied to one of its bays (Bay 1) in January 1981. All waste applications made to Landfarm II have been recorded since November 1980. Waste applications made to this Landfarm prior to November 1980 can be projected based on the application rates made to the landfarm system since November 1980.

Waste degradation rate determinations will be made by plotting chemical constituent or material concentration in pounds per cubic foot of soil in the zone of incorporation (the top 18 inches of soil in the treatment zone) versus time as illustrated in Figure 2-1. The degradation rate for a particular constituent

TABLE 2-1

EXAMPLE OF COPY OF HOVIC LANDFARM SLUDGE APPLICATION RECORDS

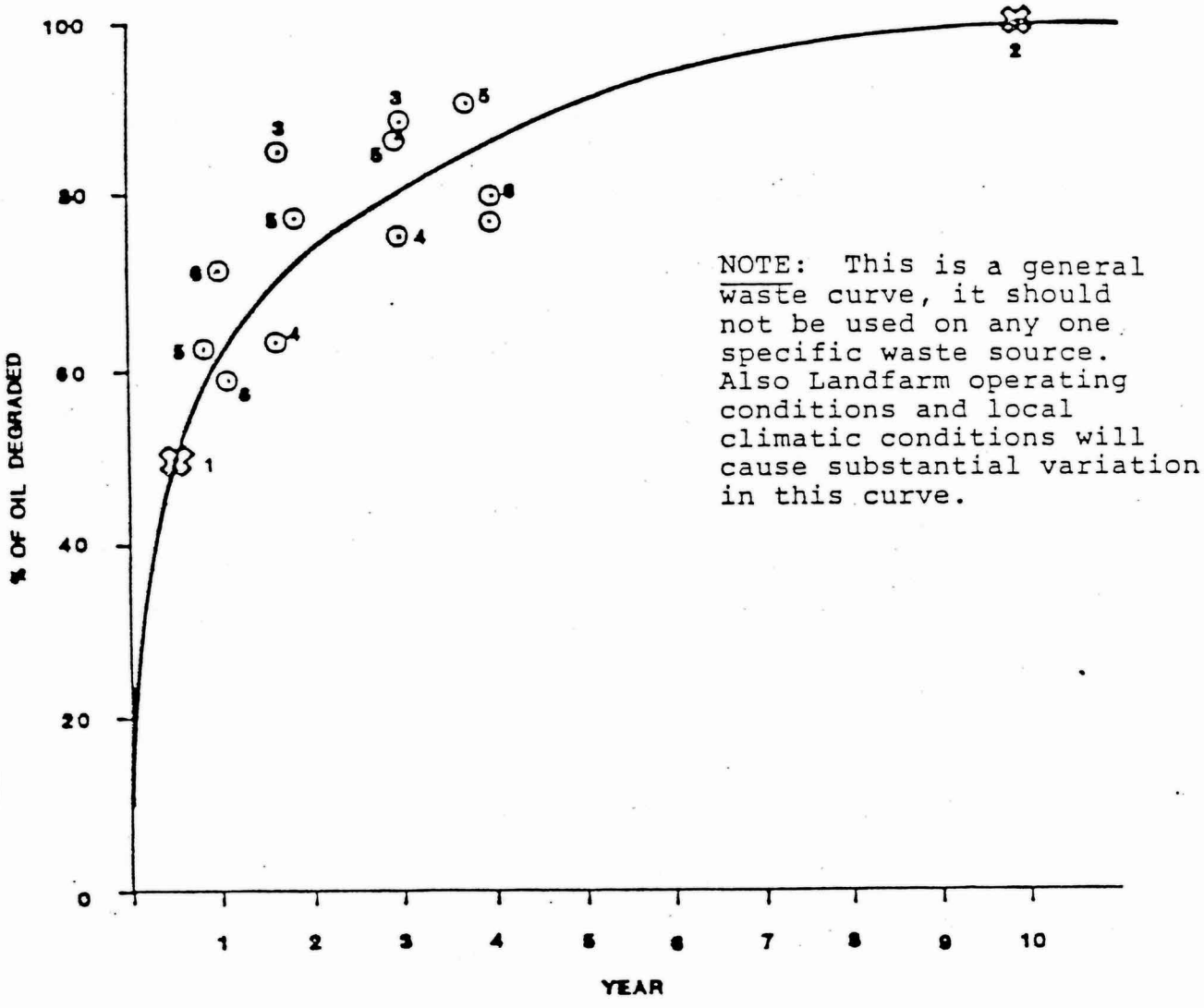
Hess RCRA Environmental Control Log

*REQUEST NO	E.C. INITIAL	* GENERATOR (NAME)	* WASTE TYPE	I.D. NUMBER	REQUEST DATE	DISPOSAL DATE	DISPOSAL CELL	APPLICATION RATE
80-0001	MWH	UTILITIES	API SLUDGE	K051	11/19/80	11/19/80	#2 SLUDGE FARM NORTH (#6 bay)	50 BBL
80-0002	MWH	"	" "	"	11/19/80	11/19/80	#2 SLUDGE FARM NORTH (BAY #6)	315 BBLS
80-0003	MWH	TURNAROUND - AREA 2 BENDER	BENDER METER CELL SLUDGE	—	11/19/80	11/19/80	LEADED SLUDGE DISP. SITE	50 BBL
80-0004	FMH	WEST UTILITIES	DESAL WATER	N/A	11/19/80	11/19/80	#2 SLUDGE FARM N. (BAY 6)	50 BBL
80-0005	FMH	WEST UTILITIES	API SLUDGE (#1,2)	K-051	11/20/80	11/20/80	#2 SLUDGE FARM N (#6)	150 BBL
80-0006	GLS	E. Utilities	3 API Sludge	K-051	11/20/80	11/20/80	#2 Sludge Farm N. Bay 6	50 BBL
80-0007	GLS	TURNAROUND - AREA 2 Bender	Wash Water	—	11/20/80	11/20/80	#2 Sludge Farm N. Bay 6	37.5 BBL
80-0008	MWH	WEST UTILITIES	#2 API SLUDGE	K051	11/21/80	11/20/80	#2 NORTH, BAY NO. 6	200 BBL
80-0009	[illegible]	E. Utilities	3 API Sludge	K051	11/21/80	11/21/80	#2 Sludge Farm, Bay 6	75 BBL
80-0010	MWH	W. Utilities	API (#1,2) Sludge	K051	11/23/80	11/23/80	#2 Sludge Farm, bay 6	25 661.
80-0011	MWH	W. Utilities (SRU #1,2)	API Sludge (#1,2)	K051	11/24/80	11/24/80	#2 North, Bay #6	125 661.
80-0012	MWH	W. Util (SRU #1,2)	API sludge (#1,2)	K051	11/25/80	11/25/80	#2 No, bay #6	200 661.
80-0013	MWH	E. Util (SRU #3,4)	API sludge (#3)	K051	11/25/80	11/25/80	#2 No., Bay #6	100 661.
80-0014	MWH	W. Util (SRU #1,2)	API sludge (#1,2)	K051	11/25/80	11/25/80	#2 No, bay #6	50 bbl.
80-0015	FMH	W. Utilities (SRU #1,2)	API SLUDGE (#1,2)	K-051	11/26/80	11/26/80	#2 No. BAY #6	150 BBLS.
80-0016	FMH	E. Utilities/SRU-3,4	API SLUDGE #3	K-051	11/26/80	11/26/80	#2 NORTH BAY #6	50 BBLS
80-0017	FMH	W. Utilities (SRU-1-2)	API SLUDGE #1+2	K-051	11/28/80	11/28/80	#2 NORTH BAY #6	100 BBL
80-0018	MWH	E. Utilities (SRU 3,4)	API SLUDGE (#3)	K051	11/28/80	11/28/80	#2 NORTH, BAY #6	50BBL
80-0019	MWH	#2 Utilities	Sulfuric (ex. 1151)	N/A	11/28/80	11/28/80	#2 NORTH BAY #6	150 BBL
80-0020	JF	#1 + #2 Sulfuric Plant	API SLUDGE (#1+2)	K-051	11/30/80	11/30/80	#2 North, BAY #6	150 BBL
80-0021	F.P.	W. UTILITIES (SRU 1,2)	API Sludge	K-051	12/1/80	12/1/80	#2 NORTH, BAY 6	150 BBL
80-0022	FP	E. Utilities (SRU-3-4	API Sludge	K-051	12/1/80	12/1/80	#2 NORTH, BAY 6	50 BBL
80-0023	FP	Marine Dept	Fire foam	—	12/1/80	12/1/80	#2 NORTH, Bay 6	100 BBLS.
80-0024	MWH	WEST UTIL (#1,2 SRU)	API SLUDGE	K051	12/2/80	12/2/80	#2 NORTH, BAY 6	200 BBLS
80-0025	FP	MAINTANCE	6876 TANK WASH	—	12/2/80	12/2/80	#2 NORTH, BAY 6	180 BBLS
80-0026	MWH	Marine	Fire Fighting Foam/Water	N/A	12/2/80	12/2/80	#2 NORTH, BAY #6	52 BBLS
80-0027	FP	BTI	Residual sludge in truck from TK 6876	N/A	12-3-80	12-3-80	#2 NORTH, BAY #6	25 BBLS
80-0028	FMH	W. Utilities (SRU 1,2	1 API	K-051	12-3-80	12-3-80	#2 North, Bay #6	150 BBLS
80-0029	FMH	E. Utilities (SRU 3,4	3 API	K-051	12-3-80	12-3-80	#2 NORTH, BAY #6	50 BBLS.
80-0030	FMH	E. Utilities/SRU-3-4	3 API	K-051	12-4-80	12-4-80	#2 NORTH BAY #6	84 BBL.
80-0031	GLS	W. Utilities/SRU 3-4	Stratford Sulfuric	N/A	12-5-80	12-5-80	#2 North, Bay #6	50 BBL.
80-0032	JAW	3-4 SULFUR/	RIVER SLUDGE/	N/A	12-6-80	12-6-80	#2 NORTH BAY #6	25 661.
80-0033	WDL	1+2 Sulfur	API Sludge	K-051	12/7/80	12/7/80	#2 North Bay #6	150 JAW
80-0034	FMH	29E. Utilities	Boiler Wash water (no #)	N/A	12/7/80	12/7/80	#2 NORTH, BAY #6	75 JAW
80-0035	FMH	W. Utilities (SRU-1-2)	#1 API	K-051	12/8/80	12/8/80	#2 NORTH, BAY #6	200 BBLS.
80-0036	FMH	#3+4 SRU	Waste Water Sulpher (no #)	—	12/8/80	12/8/80	#2 NORTH, BAY #6	100 BBLS

TABLE 2-2 EXAMPLE TABULATION SHEET OF WASTE SLUDGE APPLICATIONS

LANDFARM	REQUEST # HOVIC	DATE DISPOSAL	GENERATOR	WASTE TYPE	EPA ID #	RATE APPLICATION (BARRELS)
3020	810146	17-Feb-81	#1 & #2 SRU	#1 & #2 API	K051	180.00
3020	810147	17-Feb-81	#3 & #4 SRU	3 API	K051	120.00
3020	810149	18-Feb-81	#1 & #2 SRU	#1 & #2 API	K051	120.00
3020	810148	18-Feb-81	3-4 SULFUR	3 API	K051	120.00
3020	810150	18-Feb-81	#3 & #4 SRU	BEAVON SEWER SLUDGE	NA	180.00
3020	810152	19-Feb-81	3-4 SULFUR	BEAVON SLUDGE	NA	120.00
3020	810151	19-Feb-81	1-2 SULFUR	#1 & #2 API	K051	120.00
3020	810153	20-Feb-81	#1 & #2 SRU	#1 & #2 API	K051	180.00
3020	810155	21-Feb-81	MAINTENANCE	3 API	K051	300.00
3020	810154	21-Feb-81	#1 & #2 SRU	#1 & #2 API	K051	165.00
3020	810156	21-Feb-81	MAINTENANCE	3 API	K051	178.00
3020	810157	21-Feb-81	#3 & #4 SRU	3 API	K051	60.00
3020	810158	22-Feb-81	1-2 SULFUR	BEAVON FROTH	NA	450.00
3020	810162	23-Feb-81	MAINTENANCE	3 API	K051	250.00
3020	810160	23-Feb-81	#1 & #2 SRU	#1 & #2 API	K051	380.00
3020	810161	23-Feb-81	MAINTENANCE	3 API	K051	250.00
3020	810163	23-Feb-81	1-2 SULFUR	BEAVON FROTH	NA	800.00
3020	810159	23-Feb-81	1-2 SULFUR	#1 & #2 API	K051	380.00
3020	810165	24-Feb-81	MAINTENANCE	3 API	K051	250.00
3020	810164	24-Feb-81	1-2 SULFUR	#1 & #2 API	K051	160.00
3020	810166	24-Feb-81	MAINTENANCE	3 API	K051	200.00
3020	810170	25-Feb-81	#1 & #2 SRU	#1 & #2 API	K051	180.00
3020	810168	25-Feb-81	MAINTENANCE	3 API	K051	200.00
3020	810169	25-Feb-81	MAINTENANCE	3 API	K051	100.00
3020	810172	26-Feb-81	#3 & #4 SRU	3 API	K051	100.00
3020	810171	26-Feb-81	#3 & #4 SRU	3 API	K051	100.00
3020	810175	27-Feb-81	#1 & #2 SRU	#1 & #2 API	K051	300.00
3020	810174	27-Feb-81	#3 & #4 SRU	3 API	K051	300.00
3020	810173	27-Feb-81	#3 & #4 SRU	3 API	K051	300.00
3020	810176	28-Feb-81	#1 & #2 SRU	#1 & #2 API	K051	160.00
3020	810181	01-Mar-81	#1 & #2 SRU	#1 & #2 API	K051	100.00
3020	810180	01-Mar-81	#3 & #4 SRU	3 API	K051	300.00
3020	810179	01-Mar-81	#3 & #4 SRU	3 API	K051	400.00
3020	810182	02-Mar-81	#1 & #2 SRU	#1 & #2 API	K051	300.00
3020	810183	02-Mar-81	#3 & #4 SRU	3 API	K051	300.00
3020	810184	02-Mar-81	#3 & #4 SRU	SEWER SLUDGE	NA	300.00
3020	810187	03-Mar-81	#3 & #4 SRU	SURFACE STORM WATER	NA	600.00
3020	810185	03-Mar-81	#1 & #2 SRU	#1 & #2 API	K051	180.00
3020	810186	03-Mar-81	#3 & #4 SRU	3 API	K051	100.00
3020	810188	04-Mar-81	#3 & #4 SRU	3 API	K051	300.00
3020	810190	04-Mar-81	ENVR CONTROL	OIL SPILL RECOVERY	NA	3.00
3020	810189	04-Mar-81	#3 & #4 SRU	3 API	K051	375.00
3020	810192	05-Mar-81	#3 & #4 SRU	#3 API	K051	300.00
3020	810194	05-Mar-81	#1 & #2 SRU	#1 & #2 API	K051	120.00
3020	810191	05-Mar-81	#3 & #4 SRU	#3 API	K051	400.00
3020	810195	05-Mar-81	#5 CDU	DESALTER	NA	100.00
3020	810197	06-Mar-81	#3 & #4 SRU	#3 API	K051	400.00
3020	810196	06-Mar-81	#3 & #4 SRU	#3 API	K051	500.00
3020	810198	06-Mar-81	#1 & #2 SRU	#1 & #2 API	K051	390.00

ESTIMATED LANDFARM OIL & GREASE DEGRADATION RATES



Time

1. Source: EPA Report; SW874, April 1983 "Hazardous Waste Land Treatment": Table 7.2, page 394. Assumes waste half life @ 6 months and majority of waste organics were oil & grease.
2. Source: EPA Report, SW874; Table 6.54, page 296.
3. Source: API Report; June 1983, "Land Treatment Practices in the Petroleum Industry", Figure 2-9, page 2-47 for "Site 1"; Reduction rates @ 20 and 36 months.
4. Ditto; for "Site 2", Reduction rates @ 21 and 36 months.
5. Ditto; Figure A-12, page A-28, Reduction rates @ 12, 23, 36 & 46 months.
6. Ditto; Table 3-1, page 3-3; Reduction levels @ heavy & light loading at 14 & 48 months.

NOTE: Figure from REI Report to Amerada Hess Corporation

FIGURE 2-1 ESTIMATED LANDFARM OIL & GREASE DEGRADATION RATES

will be estimated from these plots. The data will be subjected to mathematical curve fitting such as zero order and first order curve fits as shown in Figures 2-2 and 2-3 in order to determine the degradation rates of individual constituents. As appropriate, other mathematical analyses of the data will also be used such as empirical curve fits. Data tabulated from the Hess Environmental Control Logs as given in Table 2-1 will be used along with current field data collected from the treatment zone of Landfarms II and III (described under Task 3) to determine the waste degradation rates. A confidence interval will be placed on these degradation rates where possible.

Meteorological data for rainfall and evaporation rates will be tabulated. A water balance for the HOVIC site was submitted with the RCRA Part B Permit application as shown in Table 2-3. The water balance will be expanded and will include the site rainfall data, pan evaporation data from the Upper Bethelem Experiment Station, and liquid application rates to the individual bays being used in the demonstration.

Task 2 - Determine Principal Hazardous Constituents to be Used in the Treatment Demonstration

Several waste sludge constituents have been identified in the Waste Analysis Report for HOVIC RCRA sludges as previously presented in Table 1-1. An analysis of the behavior of these waste constituents was also included in that Report. Several

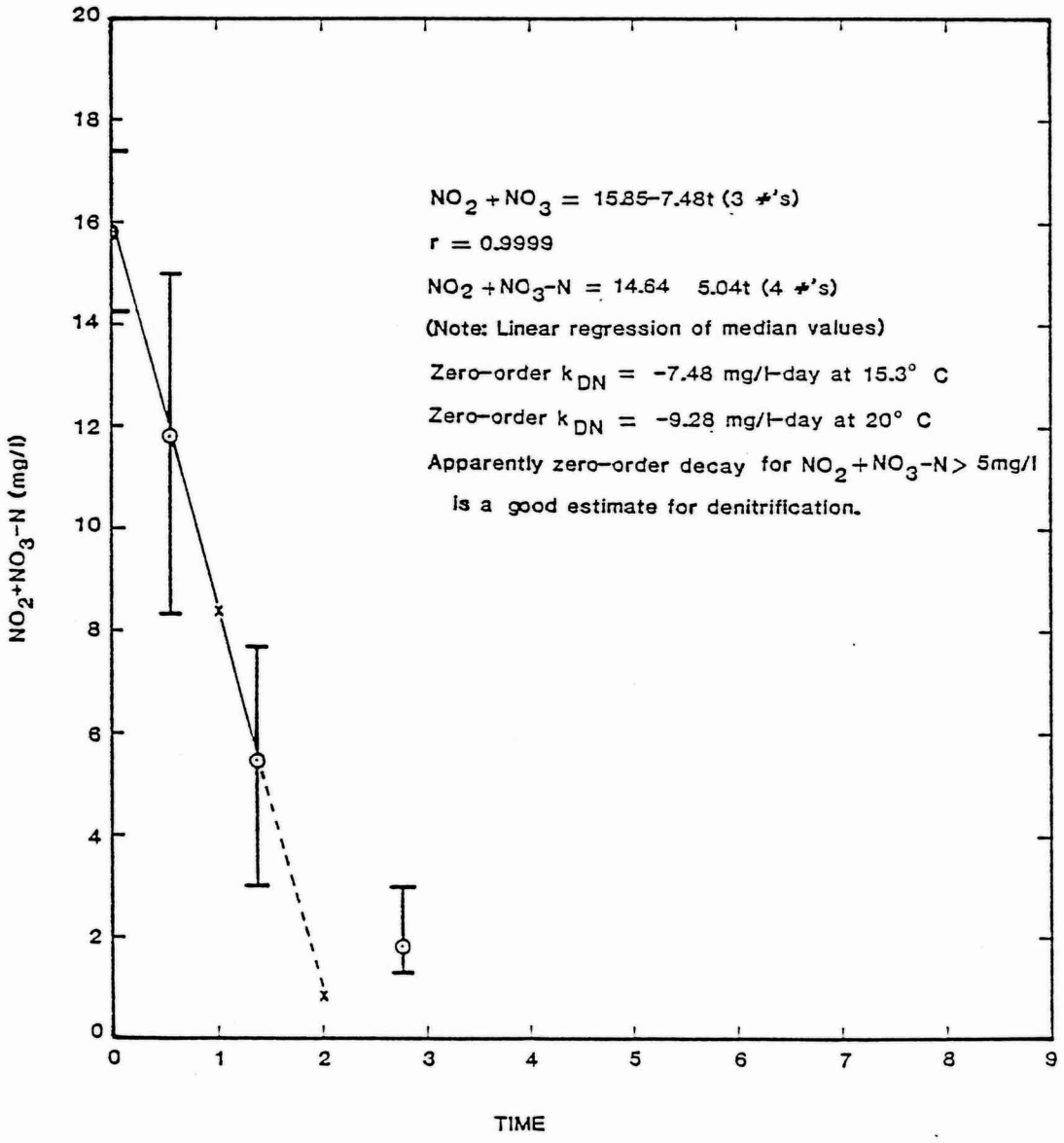


FIGURE 2-2 EXAMPLE OF ZERO-ORDER RATE CONSTANT DETERMINATION

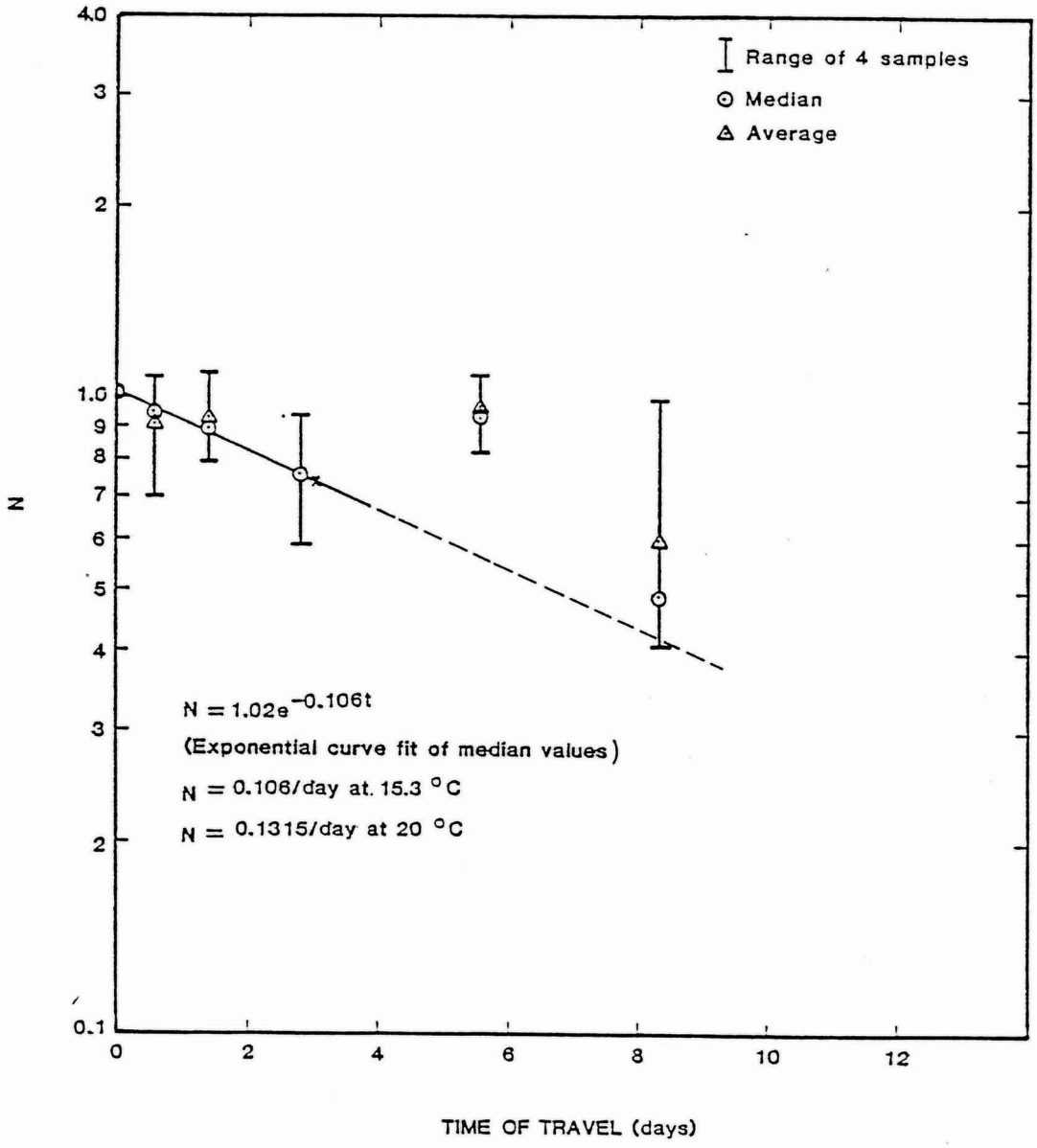


FIGURE 2-3 EXAMPLE FIRST ORDER DECAY CONSTANT DETERMINATION

TABLE 2-3 1982 WATER BALANCE FOR HOVIC SITE

Year	Month	Rainfall (inches)[a]			Pan Evaporation	
		Site 1	Site 2	Site 3	Site 3 (inches)	(% of Rainfall)[b]
1982	January	1.42	1.76	0.86	5.68	660
	February	2.41	2.53	1.71	4.87	285
	March	1.26	0.53	0.75	7.30	973
	April	1.59	0.96	1.50	6.25	417
	May	4.14	4.63	4.13	6.67	162
	June	1.86	1.43	1.78	7.28	409
	July	2.21	2.34	1.71	8.64	505
	August	2.05	1.53	1.75	7.47	427
	September	3.86	3.78	3.54	6.97	197
	October	1.44	2.88	2.37	6.93	292
	November	2.13	3.21	2.21	4.94	224
	December	3.04	4.00	3.40	5.69	
	Annual	27.41	29.58	25.71	78.69	

[a]Site 1 HOVIC Rain Gage
Site 2 A. Hamilton Field FAA (Airport)
Site 3 Upper Beth New Works (Upper Bethelehem Experimental Station)

[b]Site 3 Pan Evaporation ÷ Site 3 Rainfall
(NOTE: Evaporation loss is significantly greater than rainfall)

constituents found to be present in the HOVIC waste sludges have been selected for inclusion in the Treatment Demonstration as identified in Table 1-2. These constituents were selected because:

1. The constituents were at concentrations in the wastes which might be sufficient for monitoring in the field;
2. The constituents are selected indicator parameters for analyzing the various environmental pathways that the waste constituents might take such as biodegradation or adsorption; and
3. The constituents represent the principal hazardous and nonhazardous constituents in the wastes.

The list of indicator constituents selected from this analysis are representative of the principal hazardous constituents applied to the landfarms. The selected traditional indicator parameters including Total Organic Carbon (TOC) or Chemical Oxygen Demand (COD), oil and grease, total nitrogen, soil pH, and soil conductivity were also selected for analysis for the Treatment Demonstration. These traditional nonhazardous constituents will also be used in determining waste degradation rates and landfarm loading capacity. It is noted that of the constituents determined to be in the HOVIC waste sludges, oil is a material at concentrations which will allow a degree of measurement accuracy in the field samples -- a mixture of soil and waste sludges. For example, if we look at Table 2-2, a total

of 12,081 barrels of waste sludges were applied onto Bay 2 of Landfarm III over an 18 day period. The physical consistency of API Separator sludges based on a sample from a vacuum truck carrying API Separator sludges is:

* Oil and grease - 0.06 percent
* TSS - 32,402 mg/1 (3.2 percent)
* Moisture - 96.7 percent

The total area of Bay 2 is about 16,700 square feet and the total zone of incorporation volume in this bay is about 25,000 cubic feet.

The oily application rate to this Bay during this 18-day period was about 0.10 pounds per cubic foot of zone of incorporation. Assuming that the sludges contained approximately 234 mg/kg of benzene and 6 mg/1 of lead (see Table 1-1), the following concentrations would result in the zone of incorporation if no existing inventory of these constituents existed:

* benzene 19 mg/kg (detection limit used in waste analysis = 50 mg/kg)
* lead 0.5 mg/kg (detection limit used in waste analysis = 0.1 mg/kg)

Analytical methods to be used in this testing will be critical in being able to determine degradation rates for the PHC's. The concentrations of the PHC's in this landfarm Bay can be calculated as shown in Table 2-4. The data required to determine the

TABLE 2-4. CALCULATION OF LANDFARM LOADINGS AND CONCENTRATIONS

CONSTITUENT	APPROXIMATE WASTE CONCENTRATION (mg/kg)	APPROXIMATE ZOI CONCENTRATION (mg/kg of soil)	DEGRADATION RATE (FIRST-ORDER) (1/day)	CONCENTRATION AFTER 1 WEEK (mg/kg)
METALS				
1. barium	1370	112.6	0	112.6
2. chromium	20	1.6	0	1.6
3. lead	5.8	0.5	0	0.5
4. vanadium	77	6.3	0	6.3
VOLATILES				
5. benzene	234	19.2	.1 - 1.0	0.6
6. toluene	595	48.9	.1 - 1.0	1.5
ACID				
7. 2,4-dimethylphenol	0	0.0	.01 - 1.0	0.0
BASE-NEUTRAL				
8. benzo (a) pyrene	0.297	.0	.001 - .01	0.0
9. naphthalene	14.9	1.2	.01 - .1	0.8

NOTE: C(t) = C(t=0) * EXP(-K1 * t)

where:

C(t) = concentration at some time t after waste application

C(t=0) = intial landfarm concentration after waste application

K1 = first-order waste degradation rate

existing PHC inventory in the bay and the degradation rates will be determined from data collected in the field (Task 3).

Task 3 - Intensive Field Data Collection Study

Following completion of Tasks 1 and 2, HOVIC will submit a detailed sampling plan for the field study. This plan will include findings from Tasks 1 and 2 which were used in selection of individual bays for sampling. A meeting between EPA and HOVIC is suggested to discuss the selected bays and the sampling plan prior to initiation of the field work.

HOVIC has four years of complete records for Landfarms II and III. Applications have been made at different intervals to individual bays over the last four years. These records include waste type, total quantity, time of application, and specific bay the waste was applied. This information can be used along with field data to be collected from the bays and analyzed for specific indicator degradation constituents and products. This will include indicator principal hazardous constituents to determine waste degradation rates. The specific field data collection plan must be developed using the waste application data tabulated under Task 1.

Specifically, bays in Landfarms II and III that have had different waste loadings and different waste types applied to them are to be included in the field data collections. It will

also be important to include bays with different waste ages (for example, in Landfarm III, Bay No. 1 was first used in January 1981 whereas Bay No. 8 was first used in March 1983). HOVIC will sample four bays with waste applications that have occurred approximately three months ago, six to nine months ago, one year and two years ago. (These are suggested time frames and may be adjusted based on actual conditions). A fifth bay will be selected as a duplicate control (primarily API Separator sludges). These five data points in time will be used to determine degradation rates. A sixth bay will be selected which has had a higher percentage of non-API Separator sludges.

Field data will include soil data collections as described in the 10 October 1984 HOVIC submittal updated in Attachment 1 of this submittal. The treatment zone sampling will include:

1. Selection of landfarm bays for sampling. Bays in Landfarms II and III will be selected for sampling based on the analysis of the waste applications from Task 1. Additionally, all bays in Landfarm II will be sampled from beneath the Treatment Zone (5 to 6.5 foot depth). These samples from Landfarm II will be composited and analyzed for soil sample waste constituents as follows:

   - two soil core samples from randomly sampled locations within each bay will be obtained from the 5 to 6.5 foot depth for all six bays of Landfarm II;

- soil core samples from two parallel bays will be composited and analyzed for constituents given in Table 2-5. A total of three composite samples will be analyzed from Landfarm II;
- individual soil cores will be saved so that further analyses can be conducted if required (based on analyses of the composite samples).

2. In each bay selected for sampling, a 50 foot x 50 foot grid as shown in Figures 2-4 and 2-5 will be laid out and locations for sampling will be randomly selected for at least 6 locations within each bay selected.
3. Soil samples from each location randomly selected in a bay will be obtained from four depths as follows:
   - surface to 1.5 feet;
   - 1.5 to 3.0 feet;
   - 3.0 to 5.0 feet;
   - 5.0 to 6.5 feet.

   All six samples from each bay and from the same depth horizon will be composited to make one sample for further laboratory analysis for selected indicator parameters and representative principal hazardous constituents (as determined under Task 2). A total of four samples representing the four depths sampled in each bay will be analyzed for the list of constituents given in Table 2-5.

TABLE 2-5. MEDIA CONSTITUENT ANALYSES DURING THE TREATMENT DEMONSTRATION

CONSTITUENT	MEDIA: TREATMENT ZONE & BELOW — SOIL CORE COMPOSITES (6 BAYS + 2 BG, 4 DEPTHS) SOIL SAMPLES (#)	TREATMENT ZONE & BELOW — LANDFARM II COMPOSITES (6 BAYS, 25-6.5 FT DEPTH) SOIL SAMPLES (#)	UNSATURATED ZONE — SOIL CORES (10 LOCATIONS) SOIL SAMPLES (#)	UNSATURATED ZONE — LIQUIDS (10 LYSIMETERS) WATER SAMPLES (#)	GROUNDWATER — MONITORING WELLS (12 WELLS)
PRINCIPAL HAZARDOUS CONSTITUENTS					
METALS					
total barium	32	3	10	0	0
total chromium	32	3	10	0	0
total lead	32	3	10	0	0
total vanadium	32	3	10	0	0
VOLATILE COMPOUNDS					
benzene	32	3	0	10	12
toluene	32	3	0	10	12
ACID COMPOUNDS					
2,4-dimethylphenol	32	3	0	10	12
BASE/NEUTRAL COMPOUNDS					
benzo (a) pyrene	32	3	10	0	0
naphthalene	32	3	10	0	0
INDICATOR PARAMETERS					
soil pH	32	3	10	10	12
soil conductivity	32	3	10	10	12
total nitrogen	32	3	10	10	12
oil and grease	32	3	10	10	12
phenols	32	3	10	10	12
total organic carbon (TOC)	32	3	10	10	12
biochemical oxygen demand (BOD)	32	3	10	10	12

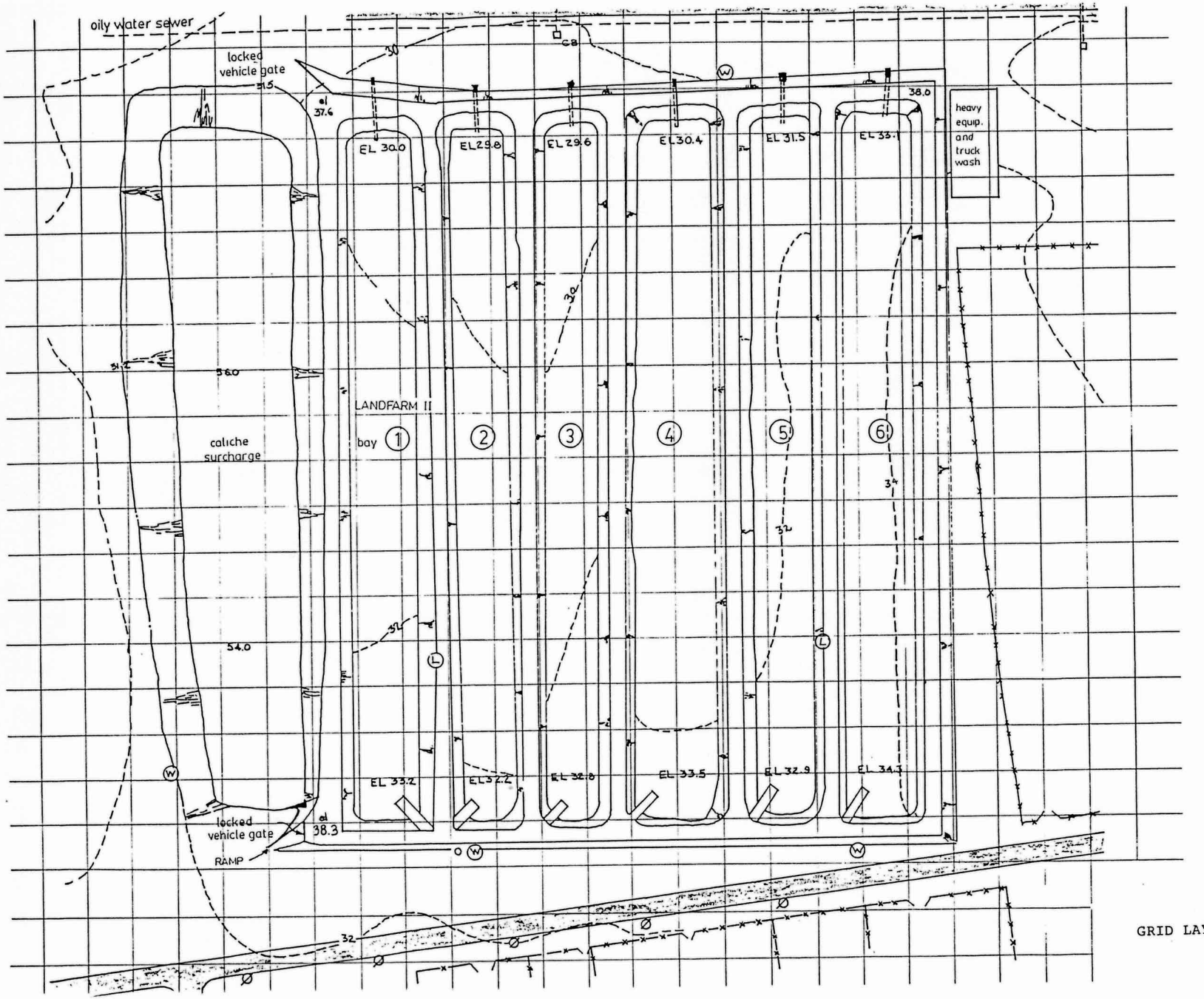


FIGURE 2-4
GRID LAYOUT FOR LANDFARM II

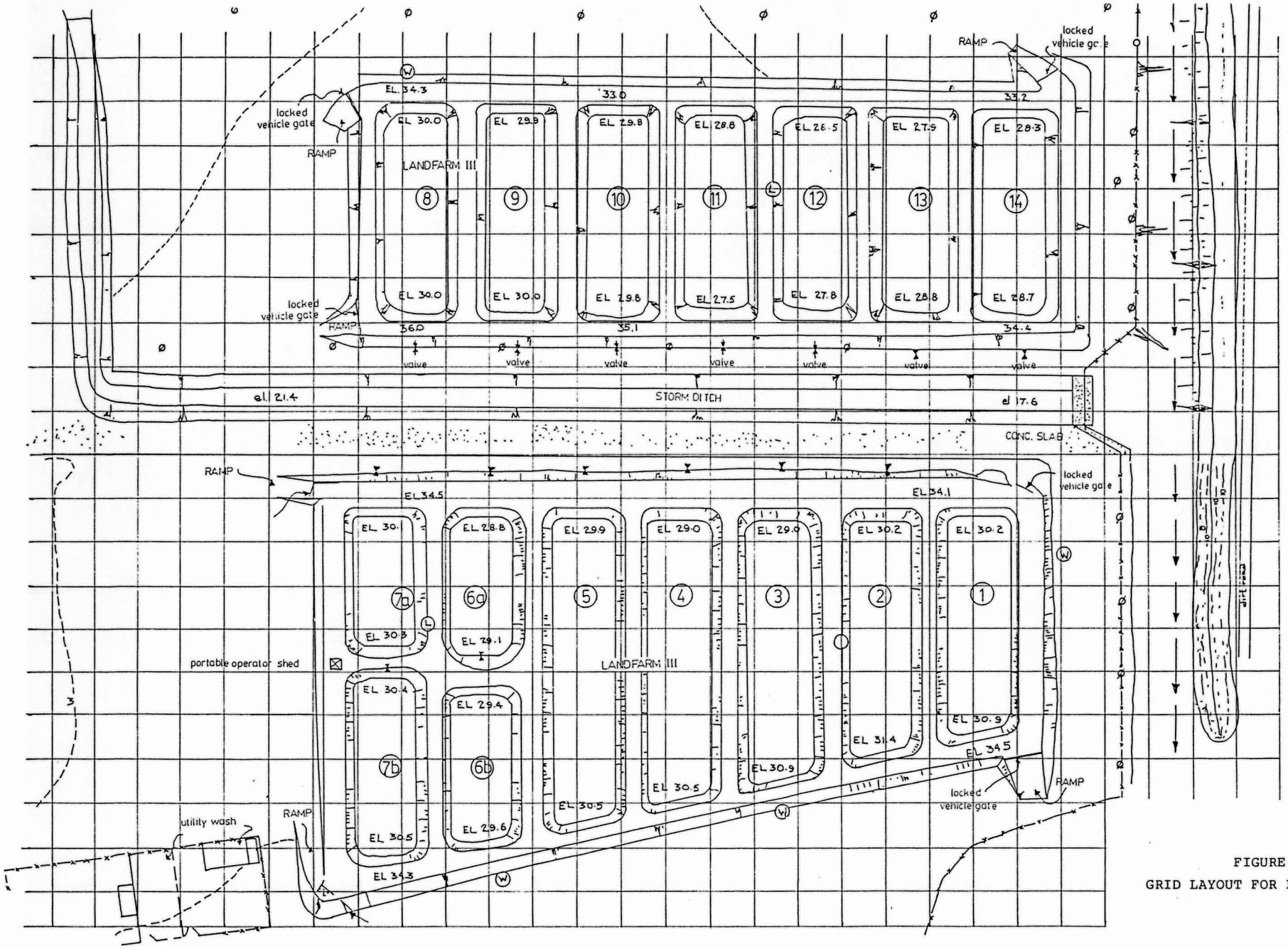


FIGURE 2-5
GRID LAYOUT FOR LANDFARM III

4. Lysimeter samples will be obtained once during the soil/waste collection period and analyzed for the constituents given in Table 2-5.
5. Groundwater samples will be obtained during the Treatment Demonstration and analyzed for constituents given in Table 2-5.
6. Toxicity testing will be conducted on the following waste sludge samples:
   - API Separator sludge;
   - Heat Exchanger Bundle Wash sludge; and
   - Recoverable (Slop) Oil tank sludge.

   Toxicity tests will include the following:
   - sludge BOD analyses will be conducted using a method developed for testing river bottom sludges. The test uses a Hach manometric (respirometer) apparatus as shown in Figure 2-6.
   - Serial dilutions of the waste sludges will be run and the diluting media will be background soils (or treatment zone soil);
   - sludge supernatant BOD analyses will be conducted using several serial dilutions;
   - TOC (or COD) analyses will be run on the waste source and the diluting media used for the serial dilutions set up for BOD analyses. This includes

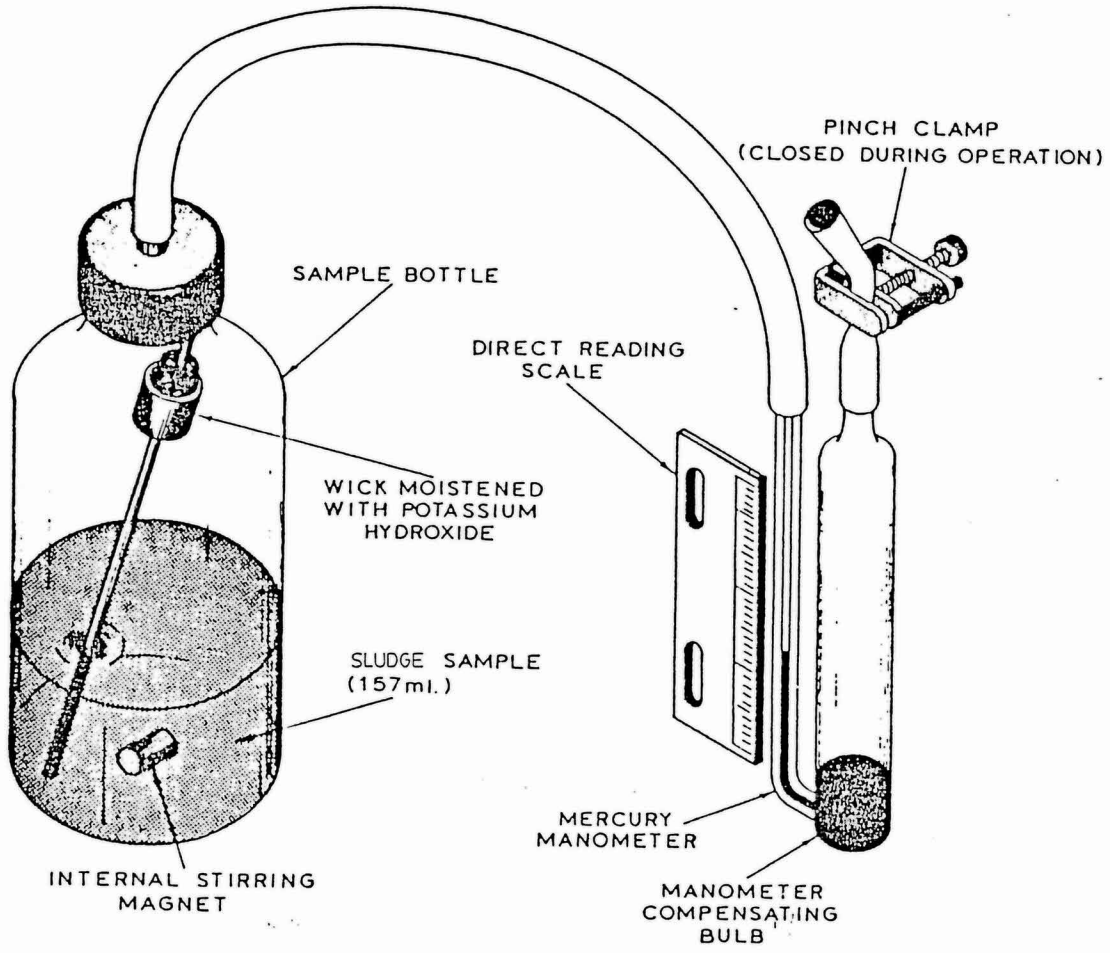


FIGURE 2-6. DIAGRAM OF HACH MANOMETRIC BOD APPARATUS

both sludge and supernatant serial dilution samples.

- The BOD/TOC or BOD/COD ratios will be compared for the serial dilutions. Concentrations for the gross parameters oil and grease, total phenols, and a specific principal hazardous constituent, benzene, will be determined for the supernatant and sludge serial dilution samples. The sludge BOD test results will be compared with the TOC analyses of the sludge and BOD/TOC ratios will be established for the serial dilutions. Inhibitory levels will be established by comparing BOD concentrations versus dilution. The BOD/TOC ratio will give a measure of relative biodegradability.

7. Sampling and laboratory analytical methodology will follow the appropriate SW-846 procedures (EPA publication, "Test Methods for Evaluating Solid Waste") or other procedures approved by EPA. The constituents to be sampled and the appropriate analytical protocols are given in Table 2-6.

Task 4 - Determine Appropriate Waste Loading Rates and Rate Limited Constituents

Laboratory analytical data collected under Task 3 will be compiled and compared with the waste loading rates compiled under

TABLE 2-6. EPA METHODS TO BE USED ON HOVIC SOILS AND WATER SAMPLES

CONSTITUENT	EPA METHOD	
	SOILS	WATER
PRINCIPAL HAZARDOUS CONSTITUENTS		
METALS		
total barium	(REQUIRES MEETING BETWEEN HOVIC AND EPA REPRESENTATIVES)	
total chromium		
total lead		
total vanadium		
VOLATILE COMPOUNDS		
benzene		
toluene		
ACID COMPOUNDS		
2,4-dimethylphenol		
BASE/NEUTRAL COMPOUNDS		
benzo (a) pyrene		
naphthalene		
INDICATOR PARAMETERS		
soil pH		
soil conductivity		
total nitrogen		
oil and grease		
phenols		
total organic carbon (TOC)		
biochemical oxygen demand (BOD)		

NOTE: SW-846 Procedures or EPA accepted substitutes will be used in all Treatment Demonstration soils and water analyses.

Task 2. Plots of residual waste quantities versus time will be made for each constituent analyzed as shown previously in Figure 2-1. Time zero waste application strength will be estimated from the waste analyses results for the selected PHC's list of constituents and from additional waste characterization for nonhazardous waste constituents.

An estimate will be made from these data on the maximum and minimum waste degradation rates achieved for the specific HOVIC environmental setting. Waste application rates and rate limiting constituents will be estimated using the following data:

- Skinner list waste analyses results;
- Climatological records since November 1980 (water balance analyses);
- Behaviour of constituents analyses;
- Waste type and waste loadings applied to the individual landfarm bays since November 1980;
- Soil descriptions of the treatment zone in the individual landfarm bays;
- Residual waste quantities at depth in the landfarm bays; and
- Degradation rate determinations for each constituent. If a constituent is not found at significant concentrations, its rate will not be determined.

A report will be prepared containing data results and associated reports (such as Behavior of Constituents Report) and

submitted to the EPA. It is estimated that this report can be submitted to EPA within 10 to 12 months from project initiation (this assumes timely reviews and comments). This report will also contain suggested Permit Limits for the HOVIC landfarms.

Task 5 - Meeting to Discuss Permit Conditions

Once EPA has reviewed the Treatment Demonstration Report, it is suggested that both HOVIC and EPA representatives meet to discuss the Report findings and conclusions. Additionally, the Permit Conditions for the HOVIC RCRA Land Treatment Units should be discussed at this meeting.

The available waste loading information is important in determining the waste degradation rates. The detailed logs (over 2100 individual entries) along with the intensive field study will be used to provide a detailed assessment of the practical landfarm treatment capacities. This study will provide a realistic determination of this capacity based on actual landfarm operations. The use of selected bays based on Task 1 analyses for this in-situ treatment demonstration will satisfy the requirements specified in the Guidance Manual and will give the required data for permitting the facility within about a 10 to 12 month period.

GENERAL CLOSING STATEMENT

The limits of detection and accuracy of the sample analyses methods have not been firmly established for several of the PHC's to be monitored. Based on the waste analysis results, duplicate samples may vary in concentrations by as much as 2 to 4 times. At a meeting with EPA in December 1984, Mr. Lloyd Kahn of the EPA Edison laboratory suggested that individual samples, at or below the method detection limit, may vary by as much as three times the detection level. If a PHC is detected below the Treatment Zone (5 to 6.5 foot depth) at more than three times the detection limit, then further field sampling may be required at the sample location.

It is also noted that most Skinner list constituents were not detected or were detected at only minor concentrations in the HOVIC waste sludge samples. For this reason, the traditional sludge constituents, oil and grease and TOC, will be key indicators of the true capacities of biodegradation of the oily sludges in the HOVIC landfarms.

ATTACHMENT 1

DEFINITION OF TREATMENT ZONE SOILS

ATTACHMENT 1

DEFINITION OF TREATMENT ZONE SOILS

As part of the Treatment Demonstration field work, soil samples will be collected from Landfarm II and Landfarm III for analysis of soil properties. The treatment zone including the zone of incorporation will be described from the soil data collected. Soil maps will be constructed from the data for each landfarm including the background areas for each landfarm.

The soil sampling and analyses plan was originally proposed in the HOVIC 10 October 1984 submittal. The following tasks will be accomplished in order to define the treatment zone and also to provide additional information for the definition of waste degradation rate projections and also definition of the rate limiting constituents.

Task 1. Soil Sampling and Analyses

Soil sample locations will be selected based on a random selection process that would be coordinated with the collection of samples for waste sludge constituent analyses. Based on the Treatment Demonstration Plan developed between EPA and HOVIC since the 10 October submittal, it is suggested that soil samples be obtained from within the grid locations shown in Figures 1

and 2. Soil core samples will be field described as they are collected at 6 inch to 1 foot intervals at each location selected. Total depth of sampling will be about 6.5 feet. Representative soil samples will be selected for further soil descriptive testing in the laboratory. Field and laboratory soil tests to be run are given in Table 1. At the appropriate loctions and depths, soil samples will also be collected for hazardous and nonhazardous constituent analyses as described under Task 3 in the Intensive Field Data Collection Study.

Soil samples at Landfarm II will be collected at 12 locations. These locations will be randomly selected from the grid shown in Figure 1 for each of the 6 bays in Landfarm II (two locations per bay randomly selected). The soil sample locations selected will also serve as locations for collecting samples for hazardous and nonhazardous constituent analyses from beneath the Treatment Zone (5 to 6.5 foot depth).

Task 2. Special Soil Testing

During the soil survey, additional soil analyses will be conducted either in the field or in the laboratory to determine the potential hydraulic conductivity of the unsaturated zone soils. Procedures utilized would be after those described in EPA SW-925, "Draft: Soil Properties, Classification and Hydraulic Conductivity Testing". The recommended procedures are:

1. Field Tests

   a. Crust (EPA SW-925, Section 6.2.2, p. 101); or

   b. Instantaneous Profile (EPA SW-925, Section 6.2.1., p. 105).

2. Laboratory Tests

   a. Long column (EPA SW-925, Section 6.2.1, p. 89)

Test Methods were presented in the 10 October HOVIC submittal.

SUMMARY

Soils will be collected and described in the field and analyzed in the laboratory during the intensive field study. It is the intent of the Treatment Demonstration Plan to coordinate both soil physical description and chemical characterization samples at the same locations, as possible. This should result in a comprehensive data set that will allow assessment of waste degradation rates.

TABLE 1

SOIL DESCRIPTIONS AND ANALYSES

Parameter	Field	Laboratory	No. of Samples
USDA Texture	x	x	(Field-All Samples)
(Grain Size)	x		(Lab-Select Samples)
Depth	x		All Samples
Color	x		All Samples
Structure	x		All Samples
Thickness	x		All Samples
Mineralogy	x		Select Representative Samples in Laboratory (Minimum of 3 per each depth for each landfarm)
Water Capacity		x	Select Representative Samples (Minimum 3 per each depth for each landfarm)
Effective Porosity		x	
Total Porosity			
Cation Exchange Capacity and Exchangeable Cations (including Sodium Adsorption Ratio)		x	Select Representative Samples (Minimum of 3 per each depth for each landfarm)
Moisture Content		x	All Samples
Soil pH		x	All Samples
Soil Conductivity		x	All Samples
Acidity			Selected Samples
Alkalinity			Selected Samples

NOTE: USDA is United States Department of Agriculture.

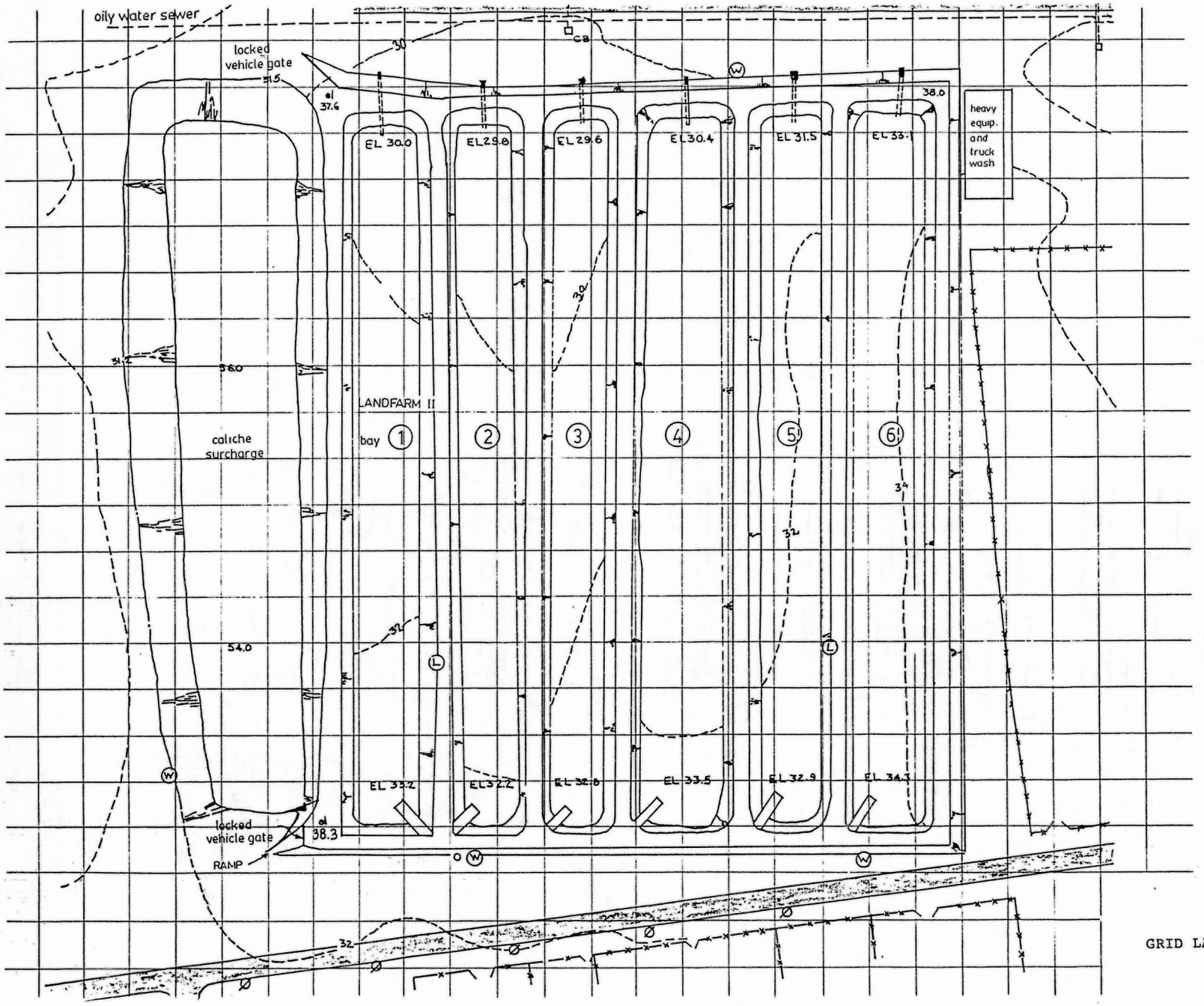


FIGURE 1

GRID LAYOUT FOR LANDFARM II

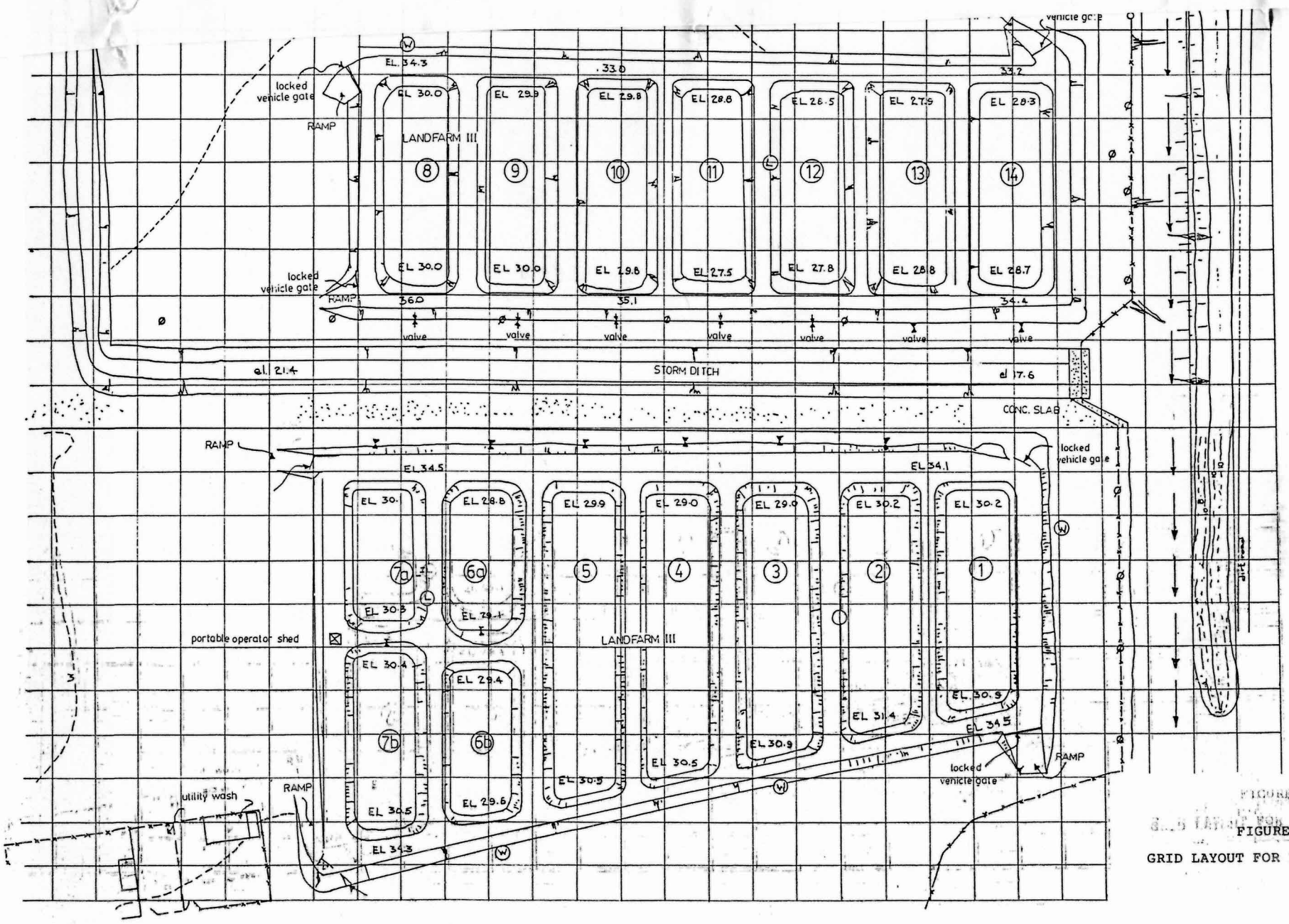


FIGURE 2

GRID LAYOUT FOR LANDFARM III